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TO ADVERTISERS
CHANGES for advertisements should be in this office by Friday noon for the following week's issue.
NEW ADVERTISEMENTS should be in the office not later than Monday noon to ensure publication in that week's issue.

Mr. E. W. Caldwell's article on another page, describing a new method of obtaining stereoscopic X-ray vision, shows the details of one of the most ingeniously beautiful devices that has lately appeared. It will undoubtedly prove of high value in surgical diagnosis.

The series of articles by Mr. J. B. C. Kershaw, on the electrochemical and electrometallurgical industry, will be resumed in an early number of the ELECTRICAL REVIEW. This valuable series is describing in detail the various electrolytic plants in the United States and Europe and will form a complete compendium of the industry. No branch of electrical application is growing more rapidly than electrochemistry and perhaps the greatest promise for future useful results that is held forth in any department of the art is found in the applications of electricity to the chemical and metallurgical processes.

*AUTOMATIC TELEPHONES.*

On other pages of this number will be found an illustrated description of the very successful and interesting automatic telephone exchange now in operation at Fall River, Mass. A consideration of the features of telephone service in that city upon the automatic basis gives rise to some very interesting speculations. Chief among them is whether the automatic system is destined to replace manual operation of telephone switchboards in whole or in part, and whether it can be adapted to the exigencies of long-distance operation.

When the history of other developments in the field of electrical engineering is considered it seems certain that the automatic telephone, now in the early stages of its development, is susceptible of great simplification and improvement and that it will undoubtedly receive these as it progresses in popular favor and is more widely extended, thus affording a larger opportunity for experiment and experience. It is undeniable that the service given at Fall River is wholly satisfactory to its patrons. There are few complaints and the public seem to realize that, as each man is his own telephone operator, each man is therefore himself responsible for faulty connections and the trouble that may ensue from them. There is a most delightful absence in the Fall River system of enquiries from the central office such as "Are you through?" or "Did you get him?" Apparently, also the secrecy of the system is appreciated by its users, and the fact that a connection once secured can not be interrupted and that disconnections are instantaneous, permitting the successive and rapid calling of a large number of subscribers, are also points which speak strongly in favor of the automatic system. But there can be no denial that the system is complicated and that certain inherent elements of weakness are found in the great multiplicity of small moving parts and contacts. This, however, in the light of the success attending the operation of telegraph and fire-alarm signal systems, which have been brought to the highest point of perfection and certainty of operation, should not be counted as a strong point in opposition to the automatic exchange. A telephone exchange is necessarily a complicated thing and it is doubtful if the automatic exchange presents any greater complexity than some of the large multiple exchanges working on the manual system. One vital point in connection with automatic exchanges in general is that the size of the exchange does not increase its complexity in a geometrical ratio. It is well known that with manual exchanges the cost of operation increases much more rapidly than the number of subscribers, and to maintain first-class service in a large exchange is proportionately much more expensive than in a small one. This is unquestionably not the case with automatic systems, in which the cost of operation seems to be fixed and proportional to the number of lines connected. The installation cost also is a simple function of the number of lines, so it seems from this point of view that the greatest success would attend the operation of large exchanges rather than small ones by the automatic method.

It is, perhaps, too early to say definitely what the future of automatic telephony will be, but it is at least suggestive to compare the automatic selector with other labor-saving apparatus, and perhaps not rash to assume that its advantages will become more evident as time goes on. So far as the adaptation of automatic systems to work on long-distance lines is concerned there seems to be no difficulty in the way, except that in the case of toll lines an operator will be required to keep books on the toll charges.

The system at Fall River is certainly exceedingly interesting and is well worth the careful attention of telephone engineers, not only for the many interesting com-

mercial features which are suggested by successful automatic operation, but also from the exceeding ingenuity and great beauty of the methods employed and the high perfection of the results attained.

### *SOUTHERN WATER POWERS.*

One of the most satisfactory signs of the times is the development of the long idle water powers in the southern states and their utilization by electric methods. For many years the manufacturing possibilities of that section of the country have been neglected, but the new awakening to the industrial possibilities of the Atlantic seaboard states has stimulated in great degree the development of the splendid powers which are found along the whole eastern slope of the Appalachian chain from the Potomac River to Georgia. Nowhere else in the world is water power more potentially useful than in this section. The climate is such that power may be developed throughout the year to great advantage, and the constantly increasing manufacturing industries of the region will doubtless absorb it as fast as it can be developed. The southern states to-day present one of the most attractive fields for engineering development in the United States, and the number of plants now under erection or in contemplation in that section is a gratifying indication that this fact has been appreciated. Already the centre of the cotton manufacturing industry has moved to South Carolina, where the raw material is immediately at hand, and no doubt the electrical development of the water powers in the southern states will shortly bear fruit in an increasing and abundant prosperity in that region.

### *POLITICS AND TECHNICAL OFFICES.*

There is no worse feature of the general municipal mismanagement which this country now suffers than the introduction of politics into the selection of persons to fill offices requiring technical ability. The number of such offices is rapidly increasing and in our larger cities, especially, a great deal depends upon the proper selection and the executive fitness of such men as city engineers, electricians, coroners, architects and commissioners of various kinds having to do with engineering work. In Pittsburgh, a city which is particularly troubled with a vicious system of municipal politics, an illustration has just been furnished of the workings of this sort of thing, which is a luminous indication of what may be expected if politicians are allowed to dictate the appointment of technical officers. In that city Mr. Morris W. Mead, for many years superintendent of the electrical bureau, was recently removed from office on account of a change in political leadership. This was several weeks ago and, up to date, nobody has been found able to take Mr. Mead's place. Consequently, Pittsburgh is left without a head to this important bureau. This is only an illustration of one phase of the difficulties that follow political choice of technical officers. It is, of course, true that in this case the removal of an able and efficient public servant is followed only by a vacancy in an important office; it is not unlikely, though, that it may soon be followed by an improper appointment. It is to be hoped that the press will see its way soon to take up the discussion of these matters of vital importance and stop, if it is possible, the filling of responsible positions with incompetent men who degrade the technical service of municipalities by administering them for political purposes.

### *THE AUTOMOBILE.*

Nothing has given a more excellent idea of the extent of the automobile industry in this country than the exhibition of motor vehicles which was held in New York city last week and which is described elsewhere in this issue. A large number of manufacturers are engaged in building automobiles—not in developing new ideas or in exploiting inventions, but in actually turning out machines, the great majority of which are sold before the factory work upon them even begins. Interest in automobilism as a sport and as a means of recreation is at a high point, and the industry is in a prosperous and flourishing condition.

Already a sharp line of demarcation may be drawn between the various types of automobiles and some safe prophecy indulged in regarding the future of each. At the present, in this country, at least, the steam machine is the most popular, probably for the reason that its price has been kept low by competition and for other reasons, and very large numbers of steam operated automobiles have been put upon the market and have proved satisfactory to their users. Competent critics, however, regard the development of this type of motor vehicle as having reached its limit, and are inclined to predict a decrease of popularity of the steam operated types in favor of internal-combustion apparatus for high-speed, racing and long-distance touring, and the electric automobile for steady work in cities.

The reason is found in the considerable complexity of the steam automobile and in the necessity its operation imposes for some knowledge of mechanics. In the minds of persons versed in steam engineering the steam automobile is an exceedingly efficient, satisfactory and reliable machine, capable of high speed and having much endurance. In the hands of one not versed in mechanics, however, it is apt to exhibit unpleasant traits, while it requires no little attention to watch its numerous valves, gauges, etc. So far as the element of safety goes, it seems fair to say that the steam machine, with its tank of gasoline under air pressure, is the least safe of the three forms.

For speed, that is, for racing, probably nothing can compete, for a long time, at least, with the internal-combustion engine or gasoline machine, which is able to develop remarkably high power with small weight and at small expense. The disadvantages of this type of automobile are so prominent, however, that it is believed its use will be restricted, and its devotees will in time discover that the electric motor car is the least troublesome to operate and most satisfactory in the end, unless they are striving for racing records or touring across country for long distances.

The development of the electric automobile has proceeded to that point where it is safe to say that the machine is practically perfect if—and the if is a large one—the proper accumulator can be discovered. Of all the forms of automobile those operated by electricity are at once the safest, the most easily handled and most satisfactory to the person operating them. The necessity for a light and powerful storage battery for use in connection with these machines has greatly stimulated invention and it is confidently believed that batteries better adapted for them than those in present use will shortly be put upon the market in commercial shape. When this happy day arrives it is believed that the electric automobile will have practically no competitor.

## THE THEORY OF ALTERNATING DYNAMO ELECTRIC MECHANISMS—XLVIII.

BY W. ELWELL GOLDSBOROUGH.

Having developed the preliminary phase diagrams, it is necessary for us to combine them in order that the final phase diagram may be developed. Under final conditions, we will assume that each

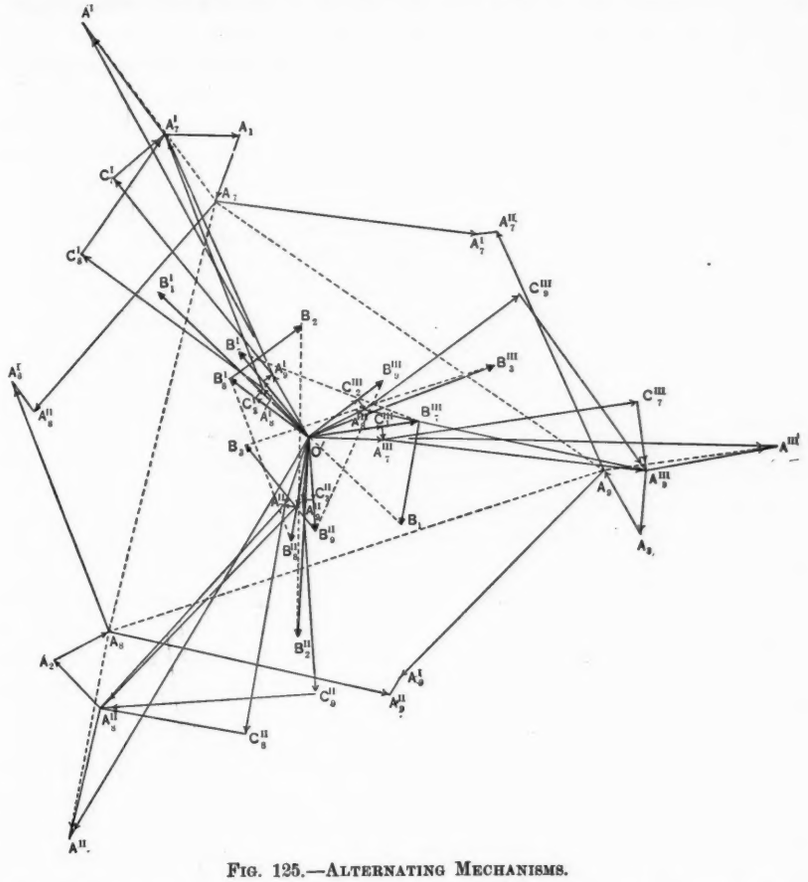


FIG. 125.—ALTERNATING MECHANISMS.

of the phases of the alternator develops an electro-motive force of 1,200 volts. By a suitable proportional reduction in the lengths of the vectors shown in Figs. 122, 123 and 124, they can be combined into a single diagram. The vectors of Fig. 122 should be reduced in the ratio of the vector $O'A^I$ of Fig. 125 to the vector $OA^I$ of Fig. 122. The vectors of Fig. 123 should be reduced in the ratio of the vector $O'A^{III}$ of Fig. 125 to the vector $OA^{III}$ of Fig. 123; and, finally, the vectors of Fig. 124 should be reduced in the ratio $O'A^{II}$ of Fig. 125 to the vector $OA^{II}$ of Fig. 124, it being remembered that the lengths $O'A^I$, $O'A^{III}$ and $O'A^{II}$ are all equal.

The result of these proportional reductions and the transfer of the vectors to the new figure give Fig. 125 as a whole, and, from this figure, by a proper combination of the vectors herein shown, the final currents and electro-motive forces active in the different receiver and line circuits are determinable. For instance, the final electro-motive force impressed on the line $A_1A_7$ will be the resultant of all of the partial electro-motive forces impressed upon this line when the phases are individually active, therefore, the final value of this electro-motive force will be equal to the vector resultant of the vectors $A^IA_7^I$, $O'A_7^{III}$ and $O'A_7^{II}$ of Fig. 125. Of these vectors, $O'A_7^{III}$ and $O'A_7^{II}$ are to be added and their resultant subtracted from $A^IA_7$, since the currents individually developed in this line by the electro-motive forces $E^{III}$ and $E^{II}$ act together and oppose the current developed in this line by $E^I$; therefore, from $A_7^I$ we must lay off $A_7^IA_1$ equal and parallel to $O'A_7^{III}$, and $A'A_1$ equal and parallel to $O'A_7^{II}$. The vector distance between $A^I$ and $A_7$ now gives the electro-motive force finally acting on the line $A_1A_7$. Similarly, the electro-motive force acting on the line $A_2A_8$ is the resultant of the vectors $A^{II}A_8^{II}$, $O'A_8^I$ and $O'A_8^{III}$. This resultant is shown as the vector distance $A^{II}A_2$, since $A_8^{II}A_2$ and $A_2A_8$ are respectively parallel to $O'A_8^I$ and $O'A_8^{III}$.

The final electro-motive force absorbed in the line $A_8A_9$ is equal to the vector distance $A^{III}A_9$, this vector being the resultant of the partial vectors as shown.

By the construction now developed, three points have been determined, namely, $A_7$, $A_8$ and $A_9$. These represent, by their space positions, the potentials active on the three receiver circuits; in other words, the electro-motive force impressed upon the circuit $A_7A_9$ is equal to the vector distance connecting $A_7$ and $A_9$. If this is true, this vector distance must be the resultant of the electro-motive forces impressed upon the receiver circuit $A_7A_9$ during the development of the initial vector diagrams of Figs. 122, 123 and 124.

To prove that this is true, we will lay off from $A_7$ the vector $A_7A'_7$ equal and parallel to the vector $A_7^{III}A_9^{III}$, and from $A_9$ the vector $A_9A''_7$ equal and parallel to the vector $A_9^IA_7^I$. This construction leaves a slight gap between the vector heads A' and A''. To close this gap, we must have reference to the reduced construction of Fig. 124, as it appears in Fig. 125. Here we find the vector distance $A_9^{III}A_7^{II}$, which would normally be active and impressed upon the circuit $A_7A_9$, when phase $E^{II}$ is active. Transferring this vector length to the point $A''_7$, we find that it is exactly equal and parallel to the vector distance $A'_7A''_7$. It therefore closes the gap, and makes the chain of vectors from $A_7$ to $A_9$ complete. In the same way, the chain of vectors connecting the points $A_7$ and $A_8$ can be obtained by laying off from the point $A_7$ the vector $A_7A''_8$ equal and parallel to $A_7^{II}A_8^{II}$, and from $A_8$ the vector $A_8A'_8$ equal and parallel to $A_8^IA_7^I$. A gap $A'_8A''_8$ now remains to be filled. We, however, find, that the vector distance here involved is exactly equal and parallel to the vector distance between the points $A_8^{III}$ and $A_7^{III}$. When the chain between the points $A_9$ and $A_8$ is completed, we find the small vector distance $A_8^IA_9^I$ effective in closing the gap between the vectors $A_9A'_9$ and $A_8A''_9$.

The further solution involves the determination of the currents flowing in the line circuits and receiver circuits. The value of the current flowing in the line $A_1A_7$ is determined by taking the resultant of the partial vectors $O'B_1^I$, $O'B_8^{II}$ and $O'B_7^{III}$. Of these, $O'B_8^{III}$ and $O'B_7^{III}$ are to be added and their sum subtracted from $O'B_1^I$. We therefore lay off from $B_7^{III}$ the vector $B_7^{III}B_1$ equal and parallel to $O'B_8^{II}$. The vector distance between the points $B_1^I$ and $B_1$ is then equal to the current flowing in the line $A_1A_7$.

Similarly, collecting the partial current vectors influencing the line circuit $A_1A_8$, we determine that, finally, a current equal in value to the vector distance $B_8^{II}B_2$ will flow in this line; and that a current represented by the vector distance $B_8^{III}B_2$ will flow in the line circuit $A_8A_9$.

# Science Brevities

**Nature of Lightning**—Herr K. R. Koch has found that lightning conductors whose connections have become imperfect through rusting or otherwise, act, nevertheless, in quite an efficient manner in the case of a thunder-storm. His article has been published in the *Physikalische Zeitschrift,* and abstracted in a British contemporary. This is, in his opinion, due to the oscillating character of lightning discharges. Electromagnetic waves are produced, which act upon the imperfect connections as upon a coherer, restoring their conductivity for a more or less long period. Lightning has hitherto been considered a continuous discharge, which often becomes apparently oscillatory by quick repetition. The author employs a rapidly revolving camera in order to test this question, but does not arrive at any definite conclusion, as the flashes photographed were all too distant.

**Induced Radioactivity**—Mr. J. C. MacLennan has found some further cases of the induction of a secondary radioactivity by the action of cathode rays, which he describes in the *Physikalische Zeitschrift,* and which is abstracted in the London *Electrician.* M. Villard was the first to describe how a piece of bismuth may be converted into a radioactive body by exposing it to cathode rays. After testing a number of sulphates and sulphides without effect, the author found that the sulphates and sulphides of calcium, strontium and barium, as well as $K_2SO_4$, show a distinct induced radioactivity on heating slightly after exposure. None of these substances shows thermo-luminescence, and on the other hand, some of the most intensely thermo-luminescent "solid solutions," such as $ZnSO_4 + 1$ per cent. $MnSO_4$ show no trace of an induced radioactivity. To give an idea of the quantitative effect, it may be mentioned that the radiation of a thin layer of calcium sulphate spread over twenty sq. cm., discharged two or three units of positive electricity. No negative electricity was discharged by any of the bodies. The author supposes that they send out a number of negatively charged particles. Herr W. Kaufmann remarks on the paper that the phenomenon may be identical with that described by Herr Hallwachs.

**Sodium Electrolysis** — For obtaining sodium by the electrolytic method the Fischer process has been proven to be one of the most successful. In this process a melted bath formed of a mixture of equal molecular weights of chloride of sodium and chloride of potassium is used. By the addition of the latter chloride the bath may be kept at a lower temperature than when chloride of sodium is used alone, which presents a decided advantage as the losses of the sodium by volatilization are greatly diminished. The sodium which results from the electrolysis of this bath contains less than one per cent of potassium, provided the difference of potential between the electrodes is regulated as it should be. After trying many electric furnaces of different forms the inventor has been led to adopt one of the following type: A wide crucible, which is not too deep, is divided into two compartments by a middle partition not extending to the bottom. The walls of the compartment containing the cathode are cooled by a system of water circulation. The electrodes are placed horizontally and pass through the opposite walls of the crucible, each being thus in its own compartment and separated by the middle partition. A solid carbon is used to form the anode and the cathode is made of a metallic tube with its axis on a level with the surface of the bath. This tube is employed at the same time to draw off the melted sodium which the electrolysis produces.

**A New Form of Permeameter**—At the recent Glasgow meeting of the British Association, Professor F. G. Baily, M. A., described a new form of permeameter, which presents several noteworthy features that are noted in the *Electrical Engineer.* The apparatus depends on the measurement of the ratio of B to H in the sample experimented with. A complete magnetic circuit is formed by two lengths of the sample joined by short iron blocks at the ends. Magnetizing coils are placed round the sample. In one of the blocks is a narrow gap perpendicular to the direction of the lines of force. Above this is pivoted a pair of astatic magnets. The lower magnet is influenced by the difference of magnetic potential between the two sides of the gap, the force being proportional to B. Round the upper magnet is placed a small coil in series with the main magnetizing coils, which acts on the magnet with a force proportional to H. Using the principle of the sine galvanometer, the coil is rotated until the two forces are balanced, the position of the magnet system being along the line of the gap. Then $\mu = \frac{B}{H} = f(\theta)$. The coil is shaped to give an almost uniform scale through some eighty degrees of arc, and the permeability is read directly on the scale. The scale is calibrated for a standard size of specimen, and the value for any other size is obtained by multiplying by the ratio. A wide range is obtained by using only a part of the magnetizing coils when the permeability is high. The magnetizing force is read on a separate instrument, such as a suitable amperemeter. Regulating resistances, a reversing switch for demagnetizing, and a switch for altering the range are added.

**Action of Radium Rays Upon Selenium**—In a paper read before the Academie des Sciences the following points are brought out by M. Eugene Bloch, who has studied the action of radium rays upon selenium. In 1873 Mr. Willoughby Smith discovered that the action of light upon selenium is to diminish its electric resistance. M. Perreau, in 1899, generalized this property by showing that X-rays produce upon selenium an action which is comparable to that of light. This work made it interesting to observe what the action of the new radioactive bodies upon selenium would be. M. Bloch has shown that the action of the rays of radium upon selenium was of the same order of magnitude as the preceding, but slower in their action. A selenium element which was formed by the usual method—that of a spiral groove formed between two spiral wires and filled with selenium—possessed a resistance in the dark of about 30,000 ohms. This resistance was put in equilibrium in a Wheatstone bridge, using a sensitive Thomson galvanometer. The initial resistance in one experiment was 30,100 ohms. This diminished rapidly by 800 to 1,000 ohms under the influence of a weak, diffused light. An incandescent lamp at a distance of ten inches caused it to fall in a few minutes to 15,000 ohms. It came back very slowly in the dark to its initial resistance. A sample of radiferous carbonate of barium was then placed about a millimetre from the selenium. It had about the same surface and was covered by black paper. In this case the resistance diminished slowly and had fallen to 29,000 ohms at the end of ten minutes. Upon removing the sample, the resistance increased progressively by 800 ohms, but only came back to the initial value in two hours. In the case of a former element, which resembled the latter, there was a normal resistance of 654,000 ohms, which fell to 640,000 in ten minutes under the action of the radium rays. The action in this case is scarcely inferior to that of a feeble, diffused light. The sample of of radioactive matter used was not one of the strongest, from which it is reasonable to expect that others would have produced a greater action.

## A NEW METHOD OF OBTAINING STEREOSCOPIC EFFECTS IN THE FLUOROSCOPE.

BY EUGENE W. CALDWELL.

One of the disappointing features of the X-ray is that it gives us only shadow pictures which are subject to distortion, and from which we are therefore liable to draw incorrect conclusions.

In a fluoroscopic picture of a broken bone, for example, the fragments may appear to be in perfect alignment, but another examination from a different point of view may show that the fragments overlap or that they form an angle with each other. In order to form a correct idea of the three dimensions of an object it is usually necessary to make at least two examinations from different points of view. Ordinarily two views are made from directions at right angles to each other.

Fortunately it has been found that two X-ray shadows, made with the source of X-ray in slightly different positions, may, if viewed under proper conditions, give the effect of a stereoscopic image and show the depth and true space relations of the object.

Dr. James McKenzie Davidson, who is probably the pioneer in this kind of work, has made stereoscopic radiographs in this way and he has used the Wheatstone stereoscope for combining them to get the effect of perspective. About two years ago he applied to the fluoroscope a modification of an old method of obtaining stereoscopic effects with the magic lantern. In this method two stereoscopic pictures were projected by the lantern alternately upon a screen and the change from one to the other was made with great rapidity. In front of the observer's eyes was placed a shutter, which permitted only one eye at a time to view the screen. This shutter was operated synchronously with the changing of the pictures in such a manner that one picture was visible only to one eye and the other picture was seen only by the other eye. When this is done rapidly enough, the changing of the pictures is not noticed, and the view is seen with the stereoscopic effect, the figures standing out in relief. Dr. Davidson has applied this method to the fluoroscope in the following way:

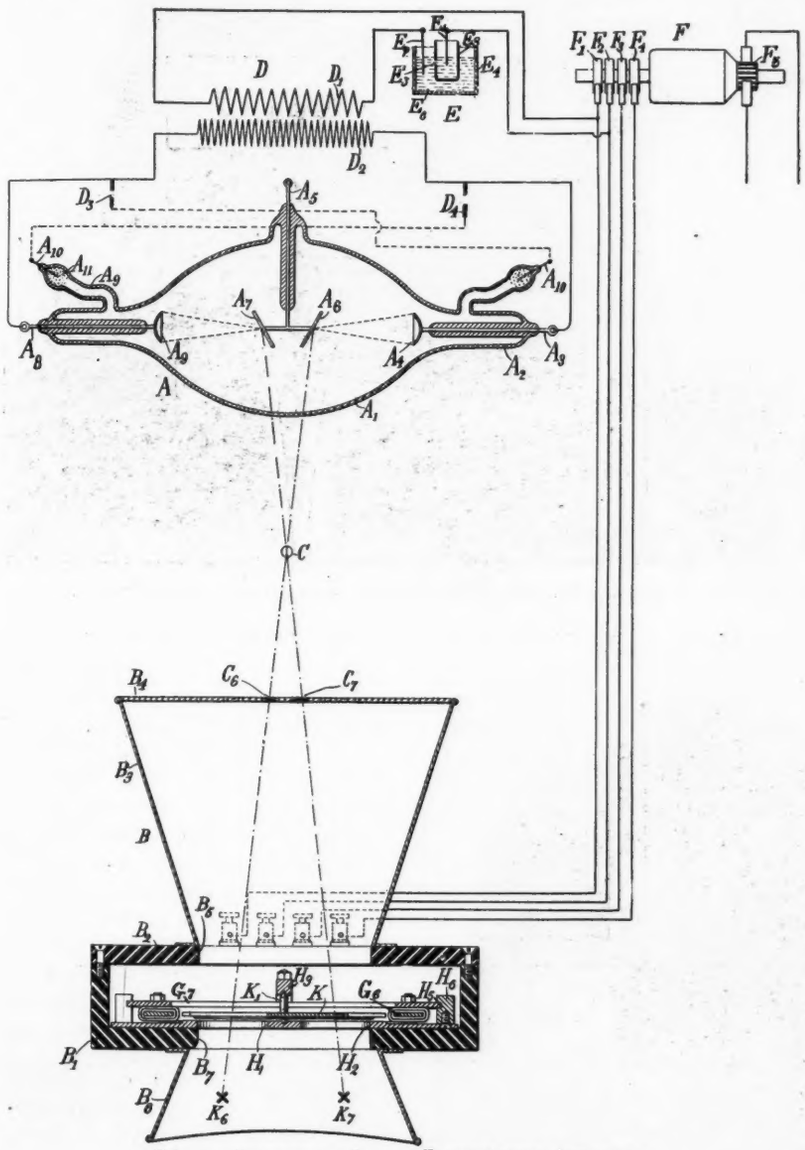



FIG. 1.—DIAGRAM OF STEREO-FLUOROSCOPIC APPARATUS.

He has two X-ray tubes placed a short distance apart, and excited alternately by an induction coil. In the field of these X-ray tubes he places a stationary fluorescent screen, in front of which are two sight holes having a shutter actuated synchronously with the changing of excitation of the two X-ray tubes. He has described two methods of obtaining the alternate excitation of the two tubes. In one of these he uses two induction coils, each connected to one of the tubes and interrupts the primary circuit of one coil and then of the other. In the other method he uses one induction coil, and switches the secondary discharge of the coil from one X-ray tube to the other by a revolving switch mechanism. Synchronism between the excitation of the tubes and the operation of the shutter is obtained by attaching the interrupter, or the switch mechanism for the tubes, and the shutter to the same shaft, which is revolved ordinarily by an electric motor. If the distance between the two tubes and their relation to the fluoroscopic screen is properly arranged, a very beautiful stereoscopic effect is produced, and the image seen on the screen, instead of appearing as a flat shadow, stands out in full relief, and appears to be really in front of the screen. There is, of course, some distortion of the shadows, and such a stereoscopic picture is, therefore, not absolutely accurate, but it is sufficiently so to be of great practical value.

It is, of course, essential with this apparatus to keep in operation two X-ray tubes which produce approximately the same effect upon the fluoroscopic screen. This is not an easy thing to do. It is well known that the character of the radiations from X-ray tubes depends much upon the degree of their vacua and this is subject to wide variations during use, and will never remain exactly the same in two tubes. Both of the methods described for exciting the two tubes alternately involve the use of switching mechanisms

which are somewhat complicated. Finally, the use of a stationary fluoroscopic screen, although it ensures the greatest accuracy, makes the machine somewhat clumsy for the examination of injured and tender limbs which must be handled carefully and which sometimes may not be placed in proper position before the fixed screen without great discomfort and even the risk of causing further injury.

In the Edward N. Gibbs X-ray Laboratory at the University and Bellevue Hospital Medical College, an attempt has been made to overcome some of these practical difficulties and a stereo-fluoroscopic system has been developed which seems to me in some respects simpler and easier of manipulation than the one just described, although its principle of operation is the same. One arrangement of this system is shown in diagram in Fig. 1. The two sources of X-ray are obtained by passing a high-potential alternating discharge through a double-focus tube having its anti-cathodes separated by about three inches. The alternating discharge may be obtained in various ways, but in the method shown here it is produced by supplying the primary winding of an ordinary induction coil with an alternating current which is broken during each alternation by a liquid interrupter (E, Fig. 1) of the type described by me in ELECTRICAL REVIEW, May 3, 1899. Referring again to the double-focus tube shown at A, Fig. 1, it will be seen that X-rays will originate at the anti-cathode, A 7, when the electrodes, A 9 and A 4, are respectively cathode and anode. When the direction of the current is reversed the rays will originate from the anti-cathode, A 6, and in operation the source of X-ray in the tube will change rapidly from one anti-cathode to the other with the alternations in the direction of the current supply to the induction coil. It will be noticed that the two sources of X-ray are within the same vacuum chamber, thus eliminating the chief difficulty in the way of obtaining from both of them radiations of the same strength and character. It will be noticed also that the method shown for exciting this tube dispenses entirely with switching mechanisms for changing from one source of X-ray to the other.

Such a tube is, in fact, easier to operate than an ordinary single-focus tube if the current supply is from an alternating incandescent lighting circuit.

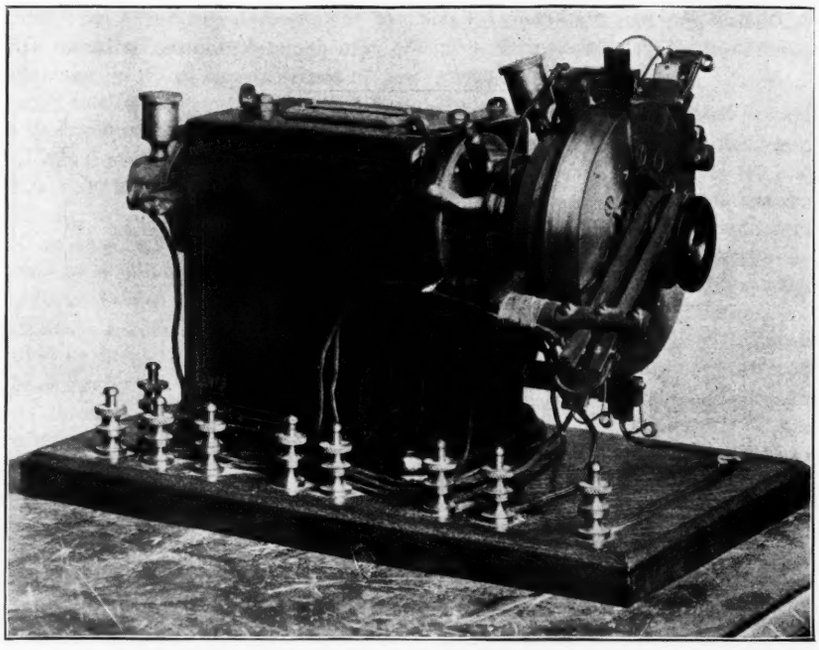


FIG. 6.—ROTARY REVERSING INTERRUPTER FOR DRIVING SHUTTER MOTOR.

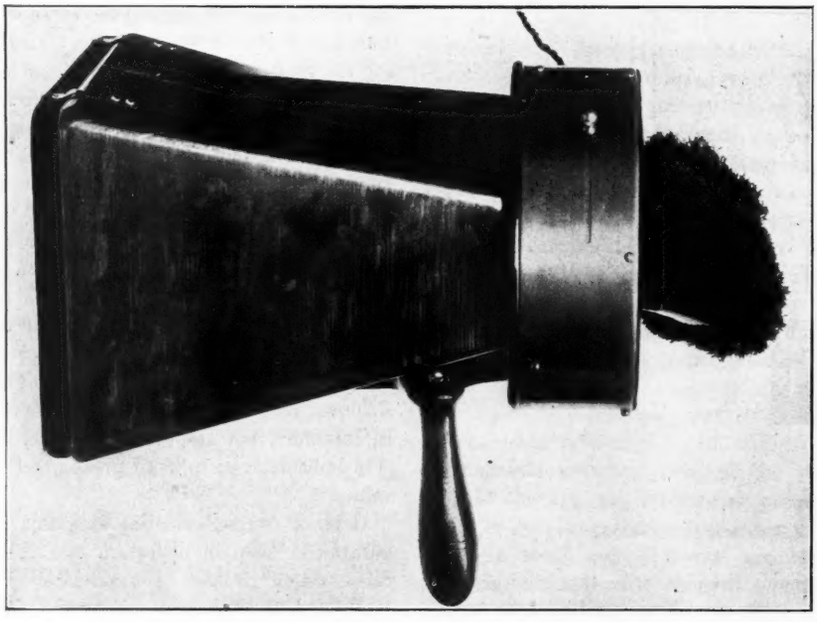


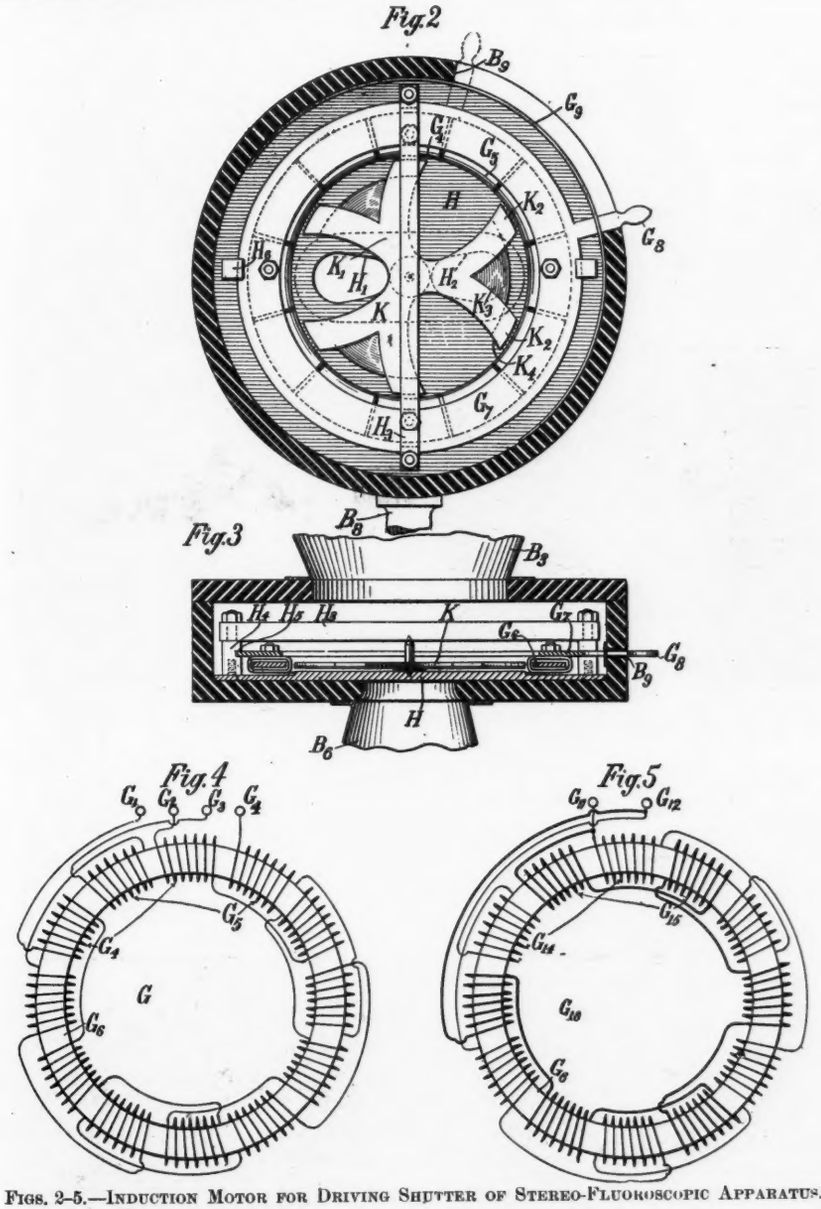
FIG. 7.—FLUOROSCOPE WITH ROTATING SHUTTER IN PLACE.

The fluoroscope used with this system is movable and resembles the ordinary fluoroscope. It is provided with a rotary shutter which permits only one eye at a time to view the fluorescent screen. This shutter is a toothed wheel which is the rotor of a small synchronous alternating-current motor. This motor may be of the mono-phase type, in which case the revolving shutter is made of steel and magnetized, but it is preferable to use a polyphase or split-phase field winding, and make the rotor of soft iron. The motor shutter is, of course, supplied with alternating current from the same source as the induction coil, and therefore operates synchronously with the alternations of current through the coil and the discharges through the double-focus tube. The shutter can, of course, be arranged to operate with an interrupted current, but the alternating current is better in many respects.

The stator of the shutter motor is arranged so that it may be turned around the axis of its armature by means of the knob G 8, Fig. 2. This is particularly for the purpose of adjusting the time of opening and closing the sight holes with reference to the periodic excitation of the X-ray tube.

For many reasons it seems best to use a six-toothed or six-pole disk (shown at K, Fig. 2) for the shutter. Such a rotor, with a properly wound stator, makes one-sixth of a revolution for each alternation of the current, and when operated from a commercial lighting circuit of sixty cycles per second makes, therefore, 1,200 revolutions per minute—a thoroughly practical speed for such a structure. When the system is operated with alternating current of this frequency there will be produced on the fluoroscopic screen 7,200 X-ray shadows per minute, each lasting for an infinitesimally short time. If the shutter is properly adjusted 3,600 of these shadows are visible to one eye of the observer and the alternate 3,600 are seen by the other eye.

The rapid succession of images gives the effect of continuous vision by each eye of the fluoroscopic picture seen by that eye, thus imitating very closely normal binocular vision and showing the shape and space relations of the object examined.




FIGS. 2–5.—INDUCTION MOTOR FOR DRIVING SHUTTER OF STEREO-FLUOROSCOPIC APPARATUS.

If the stator of the shutter motor be turned through one-sixth of a revolution by means of the knob, G 8, the action of the shutter will be reversed and each eye will see the X-ray shadow formerly seen by the other eye. The effect of this is to make the object under examination appear to be seen from the opposite side.

The system admits of many modifications to adapt it to various conditions of current supply. The simplest way to operate the system from a direct-current lighting circuit is to use a small rotary converter (F, Fig. 1) having collector rings from which a single-phase alternating current may be taken to supply the coil, and a two or three-phase current for operating the shutter. Instead of the rotary converter I have used a rotary reversing interrupter, shown in Fig. 6. This interrupter breaks the current and reverses its direction through the coil twice in every revolution. The "break-wheel" is mounted directly upon the shaft of a small direct-current motor. The armature winding of this motor is tapped at three points, from which three-phase current is taken through collector rings for operating the synchronous shutter.

In order to adapt the system for use with an influence machine for exciting the tube, such a motor could be arranged to operate a rotary switching apparatus which would change the connection of the negative terminal of the machine from one concave electrode to the other, the positive terminal being connected permanently to the "anti-cathode."

If the two concave electrodes are connected together and made permanent cathode with the anti-cathodes connected as above, the radiations from both anti-cathodes will be simultaneous. In order to obtain stereoscopic effects with the tube excited in this manner it would be necessary to place in front of the tube and close to it a thick metallic shutter arranged to intercept the radiations from each anti-cathode alternately, and synchronously with the movements of the shutter in the fluoroscope. This might be accomplished by operating the shutter in front of the tube from the shaft of a small rotary converter supplying current for the motor shutter in the fluoroscope. I have not yet tried these two modifications and am therefore unable to say how well the systems will operate in connection with an influence machine.

The use of the movable fluoroscope in this system is open to the criticism that it will give unsatisfactory results when the screen is not held in exactly the proper position with reference to the X-ray tube, but it is found that the observer readily recognizes any inaccuracies in the fluoroscopic picture of external or known parts and that unconsciously he will move the fluoroscope until the outlines which are familiar to him assume their proper form, when, of course, the internal parts of the object will be shown correctly. Moreover, it must be admitted that in examinations of surgical cases the ability to adjust the tube and fluoroscope with reference to the comfort of the patient is almost indispensable.

# The Automatic Telephone Exchange at Fall River, Mass.

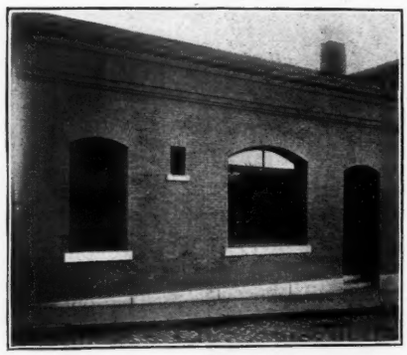
**A Telephone Exchange Without a Switchboard and Without Operators Handling the Business of a Thrifty Manufacturing City.**

AT FALL RIVER, Mass., known the world over as one of the busiest and most important of the New England manufacturing towns, there is now in successful operation an automatic telephone exchange, using the Strowger system and handling the business of nearly 600 subscribers. The exchange was built by a local company under license from the Eastern Automatic Telephone Company, of Boston, and represents the most modern and complete installation of automatic telephones in the United States.

The difference between automatic exchanges and manually operated exchanges consists in the entire suppression, in the former, of the services of a third party in making connection between two subscribers. By automatic means any subscriber is enabled instantly to connect himself with any other and also automatically to disconnect both lines when his conversation is finished. By an ingenious application the calling subscriber is prevented from interfering with the line already in use and is notified that the called party is using his telephone. The method adopted to secure this result is one of extraordinary ingenuity and interest; and while the complexity of the system is apparently very great, yet it is due simply to a multiplication of similar parts in themselves simple and, as has been proved in practice, reliable in their operation.

The system at Fall River comprises an exchange, centrally located in a small brick building shown in one of the illustrations and a full metallic system of circuits to the subscribers distributed over a large portion of the city and its suburbs. The wiring from the exchange to these subscribers is carried out underground in twisted-pair cables of the "conference" standard, made by the Standard Underground Cable Company, of Pittsburgh, and laid in conduits of the American Vitrified company's type. In the outlying districts of the city the lines are overhead, of the usual construction, cables being carried on poles to distributing boxes and circuits run thence by aerial wires to the subscribers' premises. In its external details the wiring for this exchange is precisely similar to that for any metallic-circuit exchange system using a manual switchboard; the difference is found in the subscribers' instruments and in the exchange itself.

The subscriber's station contains, besides the usual bells, transmitter, induction coil, battery and receiver, the selective calling apparatus which is mounted in a box about the size of the usual

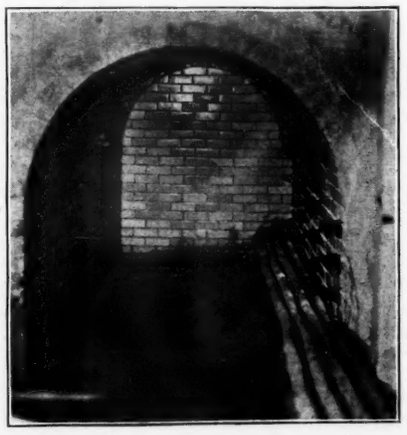


BUILDING OF THE FALL RIVER AUTOMATIC TELEPHONE EXCHANGE.

telephone magneto. On the front of this box is a disc of metal, having along the edge on one side ten holes numbered consecutively from 1 to 0. By inserting the finger in one of these holes the disc may be turned, a stop placed at the lower part limiting the distance to which it may be turned with the finger in any given hole. To call a number the subscriber first removes the receiver from its hook and inserting his finger in turn in the holes of the proper number, turns the disc until his finger is stopped at the bottom, then releases it, and lets it go back to its starting position. Having turned up the proper numbers in this way he presses a button which rings the called subscriber's bell and if the called line is not busy proceeds with his conversation. If the called line is busy, upon listening in his receiver, he hears a buzzing sound notifying him of this fact. Calling requires one second or less for each number.

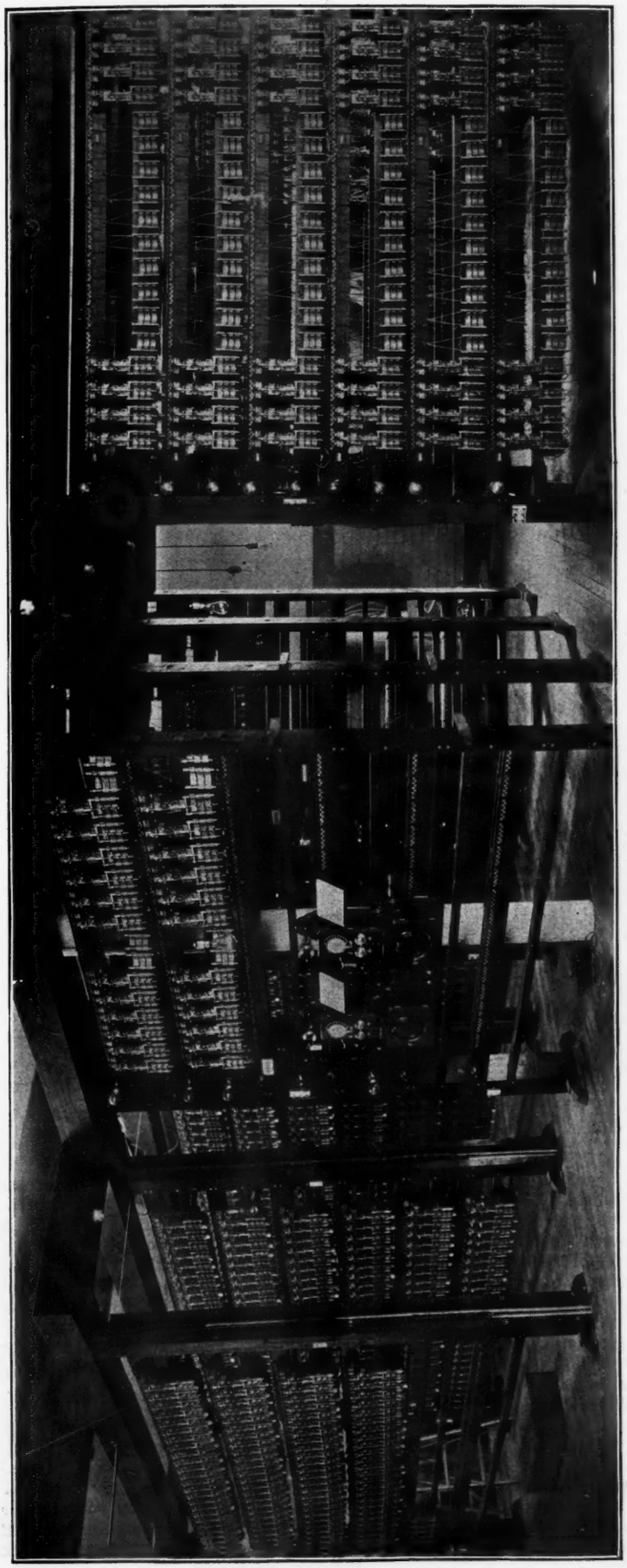
The operation of the calling device is very simple and will be explained below.

The subscribers' lines entering the exchange terminate in the usual lightning arresters and heat coils and pass thence through a distributing rack to a bank of selectors shown in the large illustration. Each line is connected with one of the selector machines, which occupies a space of about four by five inches in plan and ten inches high. The selector switch consists of 100 contacts, ranged in ten rows of ten each, mounted on a semi-circular structure, occupying the axis of which is a vertical rod adapted to be moved vertically and rotated. Better to explain the system in use the method of connecting an exchange of 100 or less subscribers will be described first. In this case each subscriber's selector is connected with all the others. The first movement of the calling subscriber's step by step selecting disc, which he operates in calling, picks out the "ten" and the next movement the "unit," this being very simply accomplished by sending in the first selective signal over one side of his two-wire circuit and the other signal over the other side, in both cases the ground being used as a return for the signaling current. Assume that the subscriber called is No. 63. The first movement to the figure 6 on the calling disc will result in stepping the vertical rod of his selector up six steps, or so that the wiping contact arm which it carries is opposite the beginning of the sixth row of contacts. The second movement to 3 will revolve the selector switch three steps,



VAULT FOR OUTGOING CABLES, FALL RIVER AUTOMATIC TELEPHONE EXCHANGE.

leaving the wiping contact on the third point on the sixth row and thus connecting the subscriber with telephone No. 63. This connection being accomplished, the caller pushes a button to ring the bell of the called subscriber and conversation




The Automatic Telephone Switchboard at Fall River, Massachusetts, Showing First, Second and Connecting Selectors for a Total of 1,000 Lines, with 564 Lines Connected and in Service.

proceeds. Should the latter, however, be already connected with some other telephone then by a simple relay mechanism an interrupted battery current is thrown on the line of the calling subscriber producing an unmistakable audible signal which informs him that the called line is busy. When the conversation is finished, hanging up the telephone of the caller sends current over both his lines and releases the step by step mechanism so that his selector on the switchboard goes back to its initial position ready for another call.

The extension of this system to an exchange having between 100 and 1,000 subscribers is exceedingly simple. In this case the first signal made instead of selecting the first digit of the called number directly connects the calling line to one of ten or more trunk lines, all of which lead to groups of instruments containing 100 in each. For example, if the number called is 546 the first signal sent in will pick out one of ten lines leading to the fifth group of 100 and the next two signals will select from this group the telephone number 46 in it giving the desired call. For exchanges to have between 1,000 and 10,000 subscribers, as in Fall River, the first two signals pick out first the thousand group, then the hundred group in which the called number is found.

It has been found in practice that ten of these trunk lines are sufficient for each 100 subscribers, as the apparatus is automatically selective and proceeds to pick out a trunk line which is not busy, passing over those which are occupied without stopping. If none of the ten lines is in use the first signal sent in by a calling subscriber will stop on the first of the lines. If this happens to be in use the instrument automatically proceeds to the second one, and so on until one line of the group not occupied is picked out. In the rare instance where all ten are busy the result is simply that the calling subscriber gets the busy signal.

Current for operating all of the signaling mechanism and the bell ringing is generated at the central exchange in a battery of thirty storage cells, which are charged at convenient intervals through a battery-charging motor-dynamo from the local electricity supply mains. For working the selector signals, direct current of about 0.1 ampere is used, while for bell ringing an alternating current is provided by the usual motor-generator set. To attempt a detailed description of the numerous ingenious points of this system would carry this article beyond its limits, and

reference can be made here only to a few of the salient features of the system.

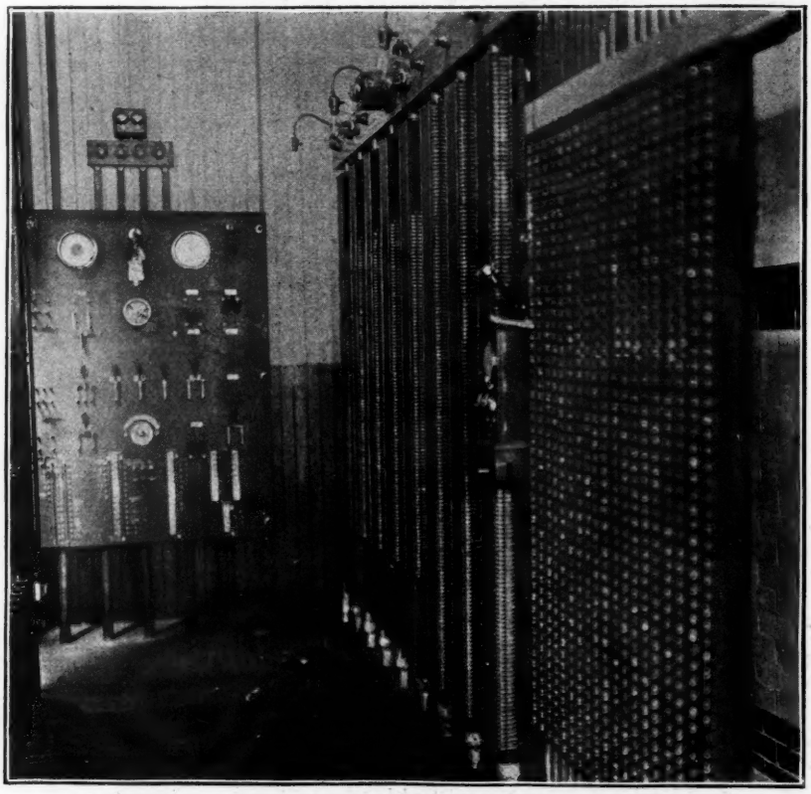
It will be noted that all of the contacts employed, except the relay used in closing the bell-ringing circuit through the called subscriber's line, are of the wipe-contact type, thus ensuring good contact and minimizing the ill effects of dust and dirt. No conversation is ever carried on through an abutting contact, all of the contacts in the talking circuit being of the wipe variety. Only two wires are run to each subscriber, and the apparatus for calling and signaling is of the central energy type, all of the current generating and converting devices being at the exchange where they are under supervision. The apparatus at the subscriber's station is no larger than that employed by other telephone systems.

The advantages claimed for this automatic system are numerous and very important. Perhaps foremost is the rapidity and certainty with which connections may be made. In a test of numbers called at random in Fall River, made by a representative of the ELECTRICAL REVIEW recently, the longest time required to ring the called subscriber's bell was seven and one-half seconds, while the average of a number of such calls fell below five seconds. Service like this is, to say the least, unusual. Another advantage that such a telephone system possesses is that it imposes the responsibility for a wrong connection upon the calling subscriber and puts in his hands, as it were, the mechanism of the exchange to work quickly or slowly, accurately or inaccurately, as he pleases. In this way a fruitful cause of complaint is abolished, while at the same time service is actually bettered. The secrecy of the service is, of course, a highly valuable feature, as is the impossibility of interruption or disconnection during a conversation.

From the point of view of the exchange itself the difference is even more marked, since the automatic system, while experience with it so far shows that the maintenance costs are practically the same as those for a manual exchange, saves the large fixed charge due to the wages of operators and attendants. In the Fall River exchange there are employed, in addition to the usual bookkeeper, collector, etc., only one attendant in the switchboard room, two inspectors and two linemen, and these spend much of their time installing new telephones. During the night and on Sunday the exchange is locked up and left to take care of itself.

Referring to the illustrations it will be seen that the space occupied by apparatus competent to take care of 999 subscribers, at Fall River, is no larger than that required for even a cramped manual exchange of the same capacity, while no provision has to be made for retiring rooms, etc., such as are found in the usual telephone exchange. Two-thirds of the installed switchboard has a capacity for 2,700 lines, the other portion requiring only additional sections to complete the exchange to that number. By the use of the trunking system the number of connections necessary to make on the switchboard and to maintain in the central office has been reduced considerably below that required for a multiple switchboard, there being necessary for each subscriber's circuit only seven connections to be made when the apparatus is installed on the board. The other connections are made at the factory when the instruments are manufactured and are, of course, there made under conditions best adapted to ensure their permanence and reliability. As the large illustration shows, the connecting cables are run in wooden troughs over the racks carrying the selector mechanisms, this construction making an exceedingly neat and simple arrangement of the exchange wiring.

The exchange opened service in September, 1901, with 400 subscribers. The actual number connected on November 9, 1901, being 590. It has given great satisfaction to its subscribers, who speak unreservedly in praise of it. The company comprises among its stockholders many users of the system, and, so far as may be judged from an external inspection, has achieved a very full measure of success in the installation and operation of its most ingenious system.



POWER SWITCHBOARD. CABLE TERMINAL BOARD. DISTRIBUTING BOARD.

POWER, TERMINAL AND DISTRIBUTING SWITCHBOARDS IN THE FALL RIVER AUTOMATIC TELEPHONE EXCHANGE.

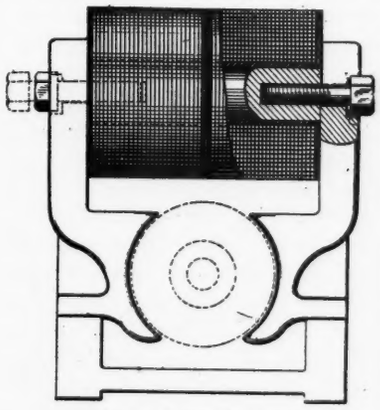
### Officials of Rapid Transit Railway Return.

The officers and engineers of the Rapid Transit Railway Company, who went to Europe a short time ago for the purpose of inspecting the latest underground railway systems which have been and are being installed there, have returned. Among these men were Messrs. August Belmont, John B. McDonald, E. P. Bryan, S. L. F. Deyo, L. B. Stilwell and John Van Vleck. While abroad these gentlemen inspected the underground system in London, for which purpose they were accorded every possible facility and courtesy. From London they went to Paris and made a thorough inspection of the railways there. While abroad some of the gentlemen inspected the steam turbine and electric works of Brown, Boveri & Company, in order to ascertain what progress had been made in the development of steam turbines as applied to electrical machinery.

The decision of Judge Thomas in favor of the Chicago Teachers' Federation in the tax case has been sustained by the Supreme Court of Illinois. This practically compels the State Board of Equalization to tax the capital stocks of all companies in the state holding municipal franchises. Many electrical corporations are affected by this decision, among them street railways, telephone and electric lighting companies.

# Electrical Patents

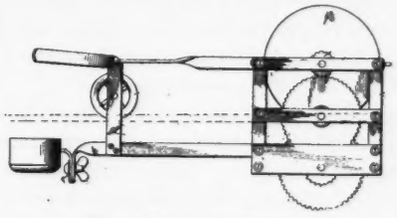
Mr. George H. Hill, of Glen Ridge, N. J., has patented a motor construction which provides a new method of attaching the field-magnets, and its object is to secure convenience, simplicity, efficiency, and economy of construction, installation and repair. The field-magnets are constructed in such a manner as to form a yoke, the two members of which are connected by a core upon which is mounted the field coils. The tops of the members of the yoke are slotted to a width sufficient to allow the bolts to pass through, and a countersink is provided for the heads of the bolts. It is often desirable and many times necessary to place the



Motor Construction.

motor very close to the device which it is designed to drive. With an ordinary motor in such a case and in others when there is not sufficient room to gain free access to the parts of the motor it becomes necessary in order to remove the field-magnets to take the entire motor from its base or otherwise disturb the adjacent structures. This difficulty is experienced by reason of the fact that the bolts must be entirely withdrawn before the core becomes freed. By this invention it is only necessary to unscrew the bolts just far enough for the heads to become freed from the yoke, when the entire field-magnets may be lifted out, the bolts passing freely through the slots. When the yokes are countersunk the bolts are less obstructive and are less likely to be damaged. Furthermore, the presence of the bolt-heads within the countersunk portion of the yokes ensures that the field-magnets shall not jump out of place should the bolts become loosened from any cause. The heads of the bolts then act as a safety device to prevent accidents. Another and important advantage to be derived from this improved construction is that brought out when installing or replacing the field-magnets of a motor. Ordinarily the field-magnets have to be suspended and centred with great care in position between the yokes before the bolts can be started into the core, an operation requiring no little time and skill. The new method is much quicker and more simple, since the bolts are started into the core before the core is put in place. After the bolts have been started into the core the coil may be slipped into position between the yokes and the bolts tightened to secure said parts in the desired position.

The operation and usefulness of telegraph and telephone wires which are carried by poles are, as is known, seriously interfered with, besides made more or less unsightly and objectionable from the fact that kite-strings, rags and other things become attached thereto between the poles. No device has heretofore been suggested for removing such material, and Mr. Austin H. Stewart, of Nashville, Tenn., has patented an invention designed particularly for that purpose. A frame is provided having a large trolley wheel mounted at one side thereof so that it may be placed upon the wire conductor without the necessity of removing part of the frame. This trolley is positively driven by any suitable motor, a spring motor being preferred, and guides carried by the frame prevent the device jumping or escaping from the wire. A forwardly extending arm projects from the lower part of the frame and a U-bracket extends upwardly from the forwardly extending arm and is braced by a stay secured to its upper end, and to the frame between the members of the U-shaped bracket is



Wire Cleaning Device.

mounted a guide wheel which also travels on the wire conductor. Guide arms are also mounted at the upper part of the U-shaped bracket and serve to gather the obstructing material from the adjacent wires. A knife or cutter bar is adjustably secured to an extension of the forwardly extending arm of the frame and has a lamp mounted at each end. In operation the lineman or operator places the apparatus on the conductor or wire, winds up the spring of the driving mechanism, and if the obstruction is in the nature of rags or cord loosely hanging from the wire or other adjacent wires he positions the cutting bar to bring the torches in a position where the flame thereof will come in contact with the material. He then attaches a cord to the rear end of the carriage and allows the motor to drive the carriage forward. After the obstruction has been removed, the carriage is drawn back by a cord, and in this connection any suitable reel can be employed by the operator. The guide arms, as will be apparent, serve to gather in obstructing material from adjacent wires, conducting the same to points within the burning zone of the torches. It may be found necessary to adjust the torches vertically, and to permit this a swivel connection at the end of the arm is provided. The device may be used for carrying a cord or conductor from one post to another, thus avoiding the necessity of the lineman taking the line along the ground to the adjacent post. When used for this purpose, it is only necessary to attach the cord or conductor to the rear end of the carriage, wind the spring, and mount the carriage upon the wire.

### International Technical Dictionary.

It has been decided definitely by the Society of German Engineers to go on with its project of compiling and publishing an international technical dictionary. The work will be called the Technolexikon, which is probably as short a name as could be selected. It will be published in three volumes, German-English-French, English-German-French and French-German-English. An editor-in-chief has been selected, namely, Dr. Hubert Jansen, who is now making up his permanent staff. The editorial office is established in the house of the society, at 49 Dorotheenstrasse, Berlin, N. W.

### Piperidin Prepared by Electrolysis.

By the reduction of pyridin in acid solutions, whether by means of the electric current or otherwise, it has long been known that the valuable stimulant piperidin is obtained. W. Pip formulates, as follows, the best conditions under which the reduction may be effected electrolytically: "The sulphuric acid must be pure, and must be present in the proportion of at least three parts to one of pyridin. The electrodes may be of lead, silver, mercury or carbon, but not of platinum. The diaphragm must be free from all traces of salts of metals other than the above." Messrs. E. Merck, of Darmstadt, are said to be about to work the process on a commercial scale.

## THE ELECTRIC TRANSMISSION OF POWER FROM NIAGARA FALLS—VI.

BY LEWIS B. STILLWELL.

Fuses and Circuit-Breakers on Long-Distance Transmission Circuits—With regard to the circuits used for transmitting power to Buffalo and other distant places, the original outfit of switching apparatus in the power-house included fuses of the expulsion type above described. These fuses were located in the switch room, and were mounted and connected exactly as are those used in the local distributing service—all feeder circuits, in fact, being treated alike in this respect.

When I became electrical director of the Cataract Construction Company and the Niagara Falls Power Company, in March, 1897, the Buffalo service, which then amounted to less than 2,000 horse-power, was supplied at 11,000 volts over transmission circuits which have been described by Mr. J. G. White in a paper read before the National Electric Light Association, in June, 1897. At Niagara three 930-kilowatt step-up transformers, supplied by the General Electric Company, and of the well-known air-cooled type, were installed, two being in service and one held in reserve. The connections used were and still are the two-phase, three-phase arrangement. Lead fuses, mounted upon a marble panel, had been placed in the 2,200-volt circuit on one side of the step-up transformers, and aluminum fuses, also mounted upon a marble panel and separated from each other by wooden barriers, were used in the 11,000-volt, three-phase circuit.

In Buffalo, in a small room adjacent to the power-house of the Buffalo Railway Company, three 250-kilowatt transformers, connected in delta, received from the transmitting circuit three-phase current at about 10,000 volts and delivered three-phase current at 375 volts to two rotary converters, which in turn delivered direct current to the circuits of the railway company. In the 11,000-volt circuits supplying the step-down transformers, aluminum fuses similar to those used on the high-potential side of the step-up transformers at Niagara were inserted. There were no fuses between the step-down transformers and the converters, but circuit-breakers were used in the direct-current circuits leading from the converters to the main bus-bars of the power-house, to which power was supplied not only from these converters, but also from a number of direct-current steam-driven dynamos. The fuses thus arranged were found to be far from satisfactory, a short-circuit on the transmission circuits in Buffalo usually blowing every fuse between the point where the short-circuit occurred and the bus-bars at Niagara. Attempts to prevent this by so adjusting the size of the several sets of fuses in series with each other as to permit only fuses at Buffalo to blow in case of trouble beyond them, and the high-potential fuses at Niagara to blow only in case of trouble on the transmission line between them and the Buffalo fuses, did not succeed. Moreover, the 11,000-volt fuses sometimes failed to clear without practically destroying their terminals and the 2,200-volt lead fuses, which contained a considerable quantity of metal, usually destroyed terminals and barriers, and continued to arc until the power was cut off.

As the long-distance service increased in amount power was supplied to other substations in Buffalo and other places, the necessity of automatic circuit-opening devices, which would localize trouble by opening branch circuits without opening the main transmission circuits at the Niagara end, and so interrupting the entire long-distance service, became very urgent, and to meet these conditions the time limit relay circuit-breaker was devised. The first of these circuit-breakers was designed in detail and constructed by the General Electric Company.

These circuit-breakers are essentially the well-known General Electric railway circuit-breaker without the secondary brake and blow-out coil, the trip coil being wound not with the main circuit, but with an auxiliary 100-volt winding supplied from a transformer, the circuit being closed through this coil by a clock-driven contact. The magnet in the main circuit controls a stop device which releases the clockwork which may be set to make the contact and trip the breaker at the expiration of a predetermined time interval. The current-carrying contacts of the breaker are shunted through long, fine fuses placed in cylinders of wood, which are provided with vents, or chimneys, through which the gas of the exploding fuse may escape. When the shunt fuse is properly connected to the circuits, these breakers open the circuit without momentary rise of potential and usually without burning the current-carrying contacts. It is necessary, however, to use great care in replacing a shunt fuse, as any failure to make a perfect connection of the shunt will result in the destruction of the breaker the next time it is called upon to act.

A number of these, and also a number of time-limit circuit-breakers, as constructed by the Westinghouse Electric and Manufacturing Company, are now in use in Niagara and in Buffalo. The essential feature of the time-limit circuit-breaker is the use of an adjustable time-measuring device which is started when the current passing through the circuit-breaker exceeds a certain predetermined value and which is used to open a circuit-breaker at the expiration of a predetermined time interval. No matter how great the current passing through the circuit-breaker may be, it can not open automatically until a definite and predetermined time has elapsed.

Eighteen step-up transformers are installed at Niagara. Three transmission circuits are available and two are normally used. Seven step-down transformers are provided in the Buffalo terminal-house and from this terminal-house eight substations, each containing from three to upward of twenty step-down transformers, are supplied. A very large number of distributing circuits radiate from substations in Buffalo. It will be seen at a glance, therefore, that so extensive a system involves necessarily a large degree of complication. Occasional accidents to the system in one part or another are practically inevitable, and since the system, overhead and underground, is interconnected, the problem of localizing trouble resulting from a failure of insulation or from other accident is a very difficult one. The attempt has been made to solve the difficulty by the use of the time-limit circuit-breaker, but up to date the results have not been entirely satisfactory. Failures, however, have been due to the circuit-breaking parts and not the time-limit device, which, in connection with circuit-breakers that can be relied upon to open their respective circuits, is a valuable feature. Time-limit circuit-breakers should be set as follows: (1) In 22,000-volt circuits at step-up transformer-house, the relays should be set to actuate circuit-breakers at expiration of about three seconds; (2) in 10,000-volt cables connecting transformers in Buffalo terminal-house to substations, they should be set to open in somewhat less time—*e. g.*, one second; (3) in distributing circuits from step-down transformers in the various substations they should be set to open instantly. If a short-circuit then occurs upon one of the branch lines from a substation, the circuit-breaker in that branch should open instantly, cutting off the supply of power to the branch without interference of service throughout the general system, but unfor-

tunately no circuit-breaker can open instantly. This being so, when the short-circuit on the branch occurs, the clock mechanism of the circuit-breakers in the 10,000-volt circuit at the terminal-house starts, as does also similar mechanism in the circuit-breakers of the high-tension lines at Niagara. As soon as the circuit-breakers on the branch at the substation have cleared, which will happen in a very small fraction of a second, the relay tripping device in the 11,000 and 22,000-volt circuit-breakers becomes inoperative, and these circuit-breakers reset themselves automatically. If for any reason the circuit-breaker in the local distributing circuit which is in trouble should fail to clear that circuit, the clock mechanisms of the circuit-breakers in the 11,000 and 22,000-volt circuits will continue to revolve until one second has elapsed, when the circuit-breaker in the 11,000-volt circuit will open and clear the circuit. The breakers in the 22,000-volt circuit at Niagara, being set for three seconds, can not yet open and they automatically reset themselves.

This, however, is theory rather than practice, as, owing to failure of circuit-breakers to clear their circuits, the operation of the time relay can not be said to have accomplished its object as yet. I believe, however, that circuit-breakers capable of opening these circuits, even under the extreme conditions prevailing when a branch is short-circuited, will be developed, and that the time-limit device in conjunction with such breakers will solve the problem. At the present time, owing to the failure of the 11,000-volt circuit-breakers at the terminal-house and the 22,000-volt circuit-breakers at the step-up transformer-house to clear their circuits, the time limit device is not used at these points.

That time and experience should be required for the development of circuit-breaking apparatus adapted to circuits conveying thousands of horse-power at 10,000 and 20,000 volts is not remarkable. Indeed, it has been strongly urged that no attempt should be made to open the power circuits while conveying large working currents. In a paper on "The Electric Transmission of Power from Niagara Falls," read before the British Institution of Electrical Engineers, November 9, 1893, the author, who, at that time, was consulting electrical engineer to the Cataract Construction Company, speaking of abnormal momentary rise in electric potential, says: "As to the cause of trouble mentioned above, I hold that it is a piece of culpable ignorance, ruinous to the machinery, if any one should ever on a large power circuit with alternating current suddenly break the circuit while current is passing. This practice is quite unnecessary, and has given rise to a large proportion of breakdowns of alternating-current machinery." In my opinion, this view is one well worthy of consideration. The answer, of course, is that unless provision is made for breaking the circuit while current is passing it becomes necessary to shut down the entire plant supplying Buffalo, Tonawanda and Lockport every time insulation fails in any part of a vast system of overhead conductors, underground cables and transforming machinery installed throughout the extensive territory supplied from the Niagara plant.

FIG. 13. INTERIOR OF NIAGARA FALLS POWER-HOUSE NO. 1.

But if in opening a branch circuit in order to localize trouble and avoid an interruption of the entire service the insulation of important parts of the system be subjected momentarily to extremely high potentials it may be argued reasonably that it would be better practice to provide no circuit-opening devices, aim to make the insulation of the entire system so perfect as to avoid any breakdowns, and when accidents did occur cut off the entire supply of power until the cause of trouble is removed. It has been my view that automatic circuit-breakers to localize trouble were essential—that the problem must be faced and solved.

In 1894, the 5,000-horse-power pneumatically operated switch was tested in opening circuits of high inductance, an adjustable spark-gap being placed in parallel with the brake and the fact was established that for the circuits, which were thought to fairly represent the most severe conditions to be expected in practical service, this switch could be used without danger of abnormal momentary potential. As this switch does not suddenly open the circuit through which the current of perhaps 1,000 amperes is flowing, but opens it through a resistance arranged as a shunt around the main contacts of the switch, the result demonstrated by the tests is accounted for; and, in fact, the switch was designed on these lines, not only with a view to safely opening the circuit but to do so without causing momentary rise of potential. Similarly, tests of fuses, enclosed in lignum-vitæ boxes provided with a vent for the escape of gas, showed no abnormal increase of potential in breaking the circuit. At a later date, tests of carbon shunt circuit-breakers, which, in opening the circuit, draw a long arc of carbon vapor, were made and no excessive rise of potential was noted; and at a still later date Mr. Steinmetz, at Schenectady, tested circuit-breakers of the type which open the circuit under oil, and he found no dangerous rise of potential. In the case of the tests at Pittsburgh, in 1894, and also in the case of tests by Mr. Steinmetz, the circuits opened were supposed to be thoroughly representative of extreme conditions to be met in practical service. It is apparently established, therefore, that the danger of causing oscillations of extremely high potential in automatically opening alternating-current power circuits operating at 25,000 volts has been surmounted. Nevertheless, up to the present time, experience with circuit-breakers at Niagara has not been satisfactory. The conditions are extreme and the causes of the failures which have occurred have been recognized and in some degree removed, but further improvement is to be desired, and I suggest that in the discussion of this paper those who have given special attention to the design, construction and use of circuit-breaking switches let the Institute have the benefit of their study and experience.

### Iron Pickled Electrolytically.

By using an electrolyte consisting of acid and alkaline, or alkaline-earthy, salts, this is done according to a recent patent in England. An example of such an electrolyte consists of 1,000 pounds of common water, 100 pounds of hydrochloric acid, 5 pounds of sulphuric, 5 pounds of hydrofluoric, and 15 pounds of caustic soda or potash. A bath lined with lead is used, and the iron or steel to be cleaned forms the cathode, the anode consisting of platinum, lead or carbon.

## INTERIOR CONDUIT CONSTRUCTION AND THE NATIONAL ELECTRICAL CODE.

BY EDWARD SULLIVAN.

Without attempting to point out the superiority of metal conduits for interior wiring as compared with other methods it is intended to call attention to a few points that should be observed in installing the conduit system of wiring. There are many makes of conduit now on the market, but as these are all made to the specifications of the national electrical code, adopted by the board of fire underwriters, they are all practically the same, as, indeed, they must be in order to receive the approval of that body. This is a matter that the underwriters are able to determine upon and control, as samples of conduit must be submitted for approval to the underwriters' Chicago headquarters, where tests and comparisons are made by the one authority and uniform decisions are rendered.

The details of conduit construction work are also regulated by the underwriters, but as these details must necessarily be watched where the work is in progress, and, therefore, require a corps of inspectors, there is, unhappily, a lack of uniformity of decisions in this particular.

Briefly, the underwriters' specifications for the manufacture of interior conduits are as follows:

They must not be less than one-half inch in internal diameter. Metal covering must be equal in strength to the ordinary commercial forms of gas pipe of the same size, and its thickness must be not less than that of standard gas pipe, as shown by the following table:

| Size. Inches. | Thickness of Wall. Inches. | Size. Inches. | Thickness of Wall. Inches. |
|---|---|---|---|
| ½ | .109 | 1¼ | .140 |
| ⅝ | .111 | 1½ | .145 |
| ¾ | .118 | 2 | .154 |
| 1 | .134 | ..... | ..... |

They must not be seriously affected externally by burning out a wire inside the tube when the iron pipe is connected to one side of the circuit. The interior surfaces of the conduit must be smooth and free from burs; the pipe must be galvanized, or the interior surfaces coated or enameled to prevent oxidation with some substance which will not soften so as to become sticky and prevent the wire from being withdrawn from the pipe; the radius of the curve of the inner edge of the elbows and bends must not be less than three and one-half inches.

It is believed that conduit made according to these specifications is sufficiently strong to withstand all ordinary mechanical assaults, is water-tight and smooth internally. It is, therefore, only necessary to secure conduit that meets the underwriters' approval. As already stated, this approval of manufactured products is intelligently determined and the best manufacturers, being zealous of their product, see to it that the standard determined by the underwriters is insisted upon by them.

Good work can only be accomplished by the use of an ample number of appropriate tools, all in good condition. It is of the greatest importance that the wireman, especially those on conduit work, should be thus equipped. I saw recently a wireman trying to ream the end of a piece of conduit with a knife. He did not succeed in removing any of the burs from the pipe, but he did succeed in developing several burs on the knife blade, and I strongly suspect that when he next attempts to use the knife on wire and fails, his ingenuity will prompt him to conclude that its only future usefulness will be as an improvised screw-driver. The knife was never intended to be used as a reamer or screw-driver, and when pressed into such service the finished work is always sufficiently lacking in detail to show the nature of the tools used in its execution, while with proper tools the finished work will possess all those distinguishing little touches which are apparent only in the work of a first-class workman. It is an old axiom that "a mechanic is known by his tools," and this is specially true of a wireman. It not only takes longer to do work with insufficient tools or tools in poor condition, but the work can not be as well done. It is therefore obvious that the objection is twofold.

The conduit should first be installed complete before any wires are drawn in, even "fish wires." Each length of conduit should be examined for obstructions, should be carefully reamed at both ends and provided with a long, clean thread so that couplings may be made up solid and tight. The conduit, when put in place, should be permanently and rigidly secured by means of pipe-hooks or straps. In laying out wiring, care must be taken to have all runs as straight as possible from outlet to outlet, and there must never be more than four elbows between the outlets. The conduit should terminate in a metal outlet box at each outlet, the conduit entering the outlet box and being rigidly secured to it so as to guard against being displaced by other mechanics. This outlet box, besides serving as a coupling for the conduit, also provides a practically fireproof receptacle for the fixture terminals in the case of fixture outlets, and for the switch terminals in the case of switch outlets. All the ends of the conduit entering the outlets, cutout cabinets, etc., should be threaded. This is necessary in order to secure the bushings to the conduit ends, as required by the underwriters, and it is also of great advantage if it becomes necessary to shift the location of an outlet or cutout cabinet, as frequently happens. The bushing referred to should be placed on all the conduit ends, in order to provide a smooth surface for the wire to pass over when it is being drawn into the conduits. The bushings should preferably be made with insulating material (although the underwriters do not insist upon this). They must be substantial and durable. The idea of having the bushings of insulating material is to guard against the possibility of the wires becoming grounded on the conduit ends. I know of many cases where expensive defects have been caused by drawing wire over the ends of the conduit without using bushings. Defects of this character are specially expensive and annoying when the injury to the insulation on the wire does not manifest itself at once, but some time after the work has been put in service. There are many bushings now on the market that have received the approval of the underwriters, after tests and comparisons, all of which are suitable for the purpose, but I believe the insulating bushings superior, as they possess the additional insulating feature mentioned.

The metal of the conduit and the conduit system as a whole should be permanently and effectually grounded. Although the necessity for this has been recognized by the underwriters, and it is called for in the national electrical code, the rule has in the past been very indifferently complied with or entirely disregarded. The subject is, however, now receiving considerable attention, as, indeed, it should, since we hear frequently of unaccountable fires due to electrical causes, which no doubt in many cases are due to a disregard of this rule. In fact, the underwriters have been able recently to trace fires directly to this cause.

Briefly, the reason for the requirement that conduits should be permanently and effectually grounded is to guard against fire in the event of the wire in the conduit becoming grounded, and because the conduit can not be permanently and effectually insulated. To accomplish an effectual ground on the entire system the conduits must be bonded together with copper wire around each outlet box, etc., carrying the wire under one of the screws

in the outlet box so as to include the outlet box. The size of this bonding wire should be the same as that in the conduit. This should be done throughout the whole system so that all the conduits will be bonded together in this manner. This system of bonding should be continued back to the switchboard or service, care being taken to have the bonding wire in all cases as large as the wire in the conduit and of greater carrying capacity than the fuse on which it is dependent. An adequate ground at the switchboard or service can be obtained by connecting to the water service pipe in the following manner, as suggested in the national electrical code:

**In connecting ground wires to piping systems, where possible, the wires should be soldered into one or more brass plugs and the plugs forcibly screwed into a pipe-fitting, or, where the pipes are cast iron, into a hole tapped to the pipe itself. For large stations, where connecting to underground pipes with bell and spigot joints, it is well to connect to several lengths, as the pipe joints may be of rather high resistance. Where such plugs can not be used, the surface of the pipe may be filed or scraped bright, the wire wound around it, and a strong clamp put over the wire and firmly bolted together.**

At a casual glance it would seem that the conduits and fittings being metal and connected together and to the gas piping would be sufficiently grounded without bonding, but this is not so, for the reason that the conduits, outlet boxes, etc., are covered with an insulating enamel that offers a varying resistance which will readily be shown by a test with a Wheatstone bridge.

To illustrate how effectual a ground should be it is only necessary to consider the case of a circuit wire becoming grounded on the conduit and the conduit having a resistance to ground of say fifteen ohms, which is by no means unusual, as I have tested completed installations where adjacent sections of conduit showed resistances varying from 0.05 ohm to 25,000 ohms. This fifteen-ohm resistance to grounding on a 110-volt circuit would permit nearly eight amperes of current flowing indefinitely without blowing the smallest fuse on the system (usually ten amperes), and I do not think that any one will try to maintain that it is safe or economical to have such current flowing at random through a building. On the other hand, if the conduit were effectually grounded, when the circuit wire came in contact with the metal conduit, there would be no resistance to ground and the flow of current would be so great that the fuse would be blown almost instantly and the circuit could not be again used until the trouble had been removed and the consequent danger of fire eliminated. In addition to the question of safety, the leakage of current, so frequent in large installations, is guarded against, as there can be no high-resistance grounds to consume current indefinitely when the conduits are properly bonded together and grounded. The test referred to, even if it showed a very low resistance to grounding, would not be sufficient, as it is necessary to know the nature of the metallic continuity, its carrying capacity, etc., as in order to prevent heating it should have a greater carrying capacity than the fuse, hence the bonding wires should be the same size as those in the conduit.

As the neutral wire on all three-wire systems is permanently grounded, it becomes all the more necessary that this detail in conduit work should be carried out. For years the underwriters held out against the grounding of the neutral wire, maintaining that it produced an unnecessary strain on the two remaining conductors, but the central station authorities, while admitting this objection, set forth advantages to be gained by the practices, which, they thought, would more than offset the underwriters' objections. Any one familiar with central station operation will, I think, agree with the central station authorities. At any rate, they have won out, and the underwriters now recommend the grounding of the neutral wire on three-wire systems, the advantages being that: It guards against the blowing of the neutral fuse and consequent destruction of lamps; localizes trouble by promptly blowing the fuse when a ground occurs on either of the outside wires, and limits the potential between grounds to 110 volts instead of 220 volts, as would be the case if the neutral wire were clear and the two outside wires became grounded.

All the foregoing suggestions are in accordance with the requirements of the board of fire underwriters, as embodied in the national electrical code, which should be followed implicitly. The national electrical code rules are all very general, and intentionally so, as it is well-nigh impossible to formulate specific rules that would cover every case. The aim has been to omit trivial items which would only narrow the scope of the rules and irritate the contractors and workmen; yet the rules are ample to ensure against any danger, if properly complied with. They are based on the practical experience of all parties concerned, and while there are many rules, the necessity for which may not be readily apparent to every one, we are bound to admit that anything that has once been the cause of trouble or danger should be guarded against in the future.

The rules are revised annually in a conference, where every item is thoroughly discussed, and such new rules and revisions of old rules as the natural evolution of the art dictates are added, but none which is not the result of experience, and solely with a view to safety.

There are, however, some inaccuracies in the wording of the code rules, as, for instance, the following:

**FIXTURE WIRE—Must have a solid insulation, with a slow-burning, tough, outer covering, the whole to be at least one-thirty-second of an inch in thickness, and show an insulation resistance between conductors and between either conductor and the ground of at least one megohm per mile, after one week's submersion in water at seventy degrees Fahrenheit, and after three minutes' electrification with 550 volts.**

If an attempt were made to apply the insulation test here prescribed, it would be necessary to wire the fixtures and submerge them in water, as the words "show an insulation resistance *between conductors and between either conductor and the ground*," surely implies that the test is made with the wire in the fixture, and I do not think that the underwriters expect manufacturers to provide fixtures that will survive "one week's submersion in water," etc. Strange to say, this and other similar errors have appeared in several editions of the national electrical code, but it is to be hoped that the next edition will see the above rule corrected by omitting the words "between conductors and between either conductor and the ground," and requiring that the test be made in the usual way by submerging the finished coils of wire in water and determining its insulation resistance per mile.

### Zinc Produced Electrolytically.

The density of the current is very unequal at the cathode in the usual methods, which receives more electricity round its outside than at its middle. Hence the precipitation of zinc is unequal in the same way. Eschellmann remedies this by making the cathode bigger than the anode, and by placing it so as to overlap the anode uniformly. In consequence of the increased distance thereby secured between the edges of the cathode and those of the anode the resistance of the electrolyte becomes larger, and the distribution of the current over the cathode more uniform.

In the Engineering Building at McGill University, Montreal, Quebec, a 300-kilowatt storage battery has been installed. The building can now be lighted without keeping the steam plant running. One of the fifty-horse-power steam dynamo units has been remodeled for charging it.

### The Automobile Show.

The automobile show at Madison Square Garden, New York city, which closed last week, was a complete exposition of the present state and development of the art of the manufacture of automobiles. It included representatives of all practical, popular, actually used kinds and styles of automobiles. Very few experimental vehicles or devices were shown and very few unmarketed patents were offered for exploitation.

First in number of vehicles shown and manufacturers showing came, as was to be expected, the steam vehicles of the well-known Locomobile type. Practically all of the makers adhered to the original runabout type, with its short wheel-base, high seat and wire wheels. Several variations were noted where there was an evident attempt to improve the lines by lengthening the wheel-base and increasing the weight to a more reasonable and safe amount.

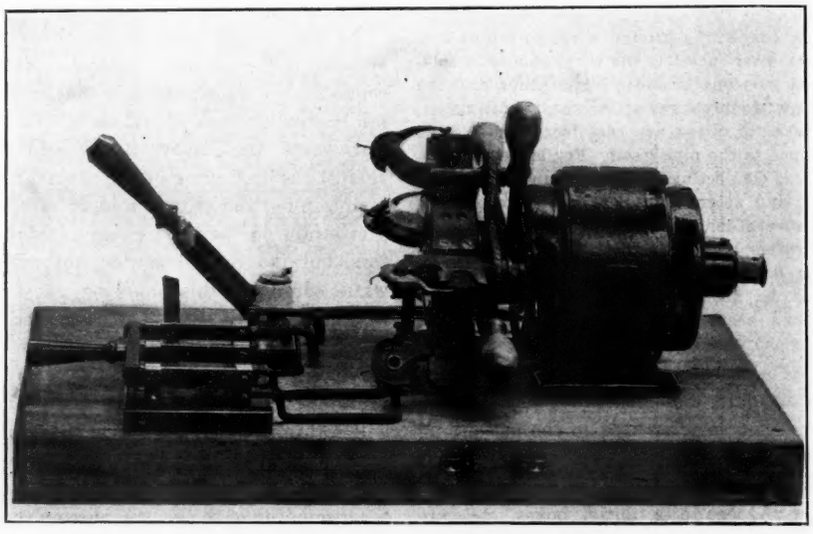
The Toledo steam wagon and the White have started experiments with new types of boilers, but it will probably be another year before it can be said that the old tubular form has been bettered. The Mobile Company showed, by its large and well-designed variety of vehicles, its recognition that there is a large use for the automobile in busine s fields for the transportation of both freight and passengers. It is the only exhibitor, other than the electric vehicle men, which shows serious designs for this class of trade. The steam vehicle sprang into front rank of popularity at one bound, and there are at present probably as many in use as of all other types put together. This is for several reasons: First, many people know how to handle steam engines that know little or nothing of explosion motors; and, second, the enterprise, push and business sagacity of the original large manufacturers in establishing large plants, with resultant economy in manufacture and consequent low selling price.

The explosion-motor, or gasoline vehicle as it is commonly called, was undoubtedly the most interesting part of the show, just as the high steppers and jumpers are at the horse show. The line was very complete, ranging from the heavy, high-speed French racers through many sizes, styles and weights to the light but practical American machines of the Oldsmobile or Crestmobile types. These latter are comfortable vehicles of fair size and give excellent service for the use intended. The extremely light motor quadricycles or tricycles shown last year are conspicuous by their absence. Two motor bicycles were shown, but these are racing machines and were shown more for the purpose of demonstrating the motor than to attempt to market the machine. It is conceded that if one wants an automobile one wants a vehicle in which one can ride in comfort and ease. Hence the tendency to heavy machines. This tendency was particularly demonstrated in the exhibits of the gasoline vehicle class. The Winton Company, the De Dion and the Gasmobile companies all showed larger and heavier machines than last year. Speed, of course, dictates the extremely long and heavy machines, but in the ordinary touring cars comfort is the argument. In this class the American manufacturers have made wonderful strides the past year. All of the American made vehicles are far superior to the comparative classes of imported machines. The Winton, the Robinson, the Long Distance, the Autocar, the Automotor are all much superior to the French makes in style, mechanism, ease of control, noise and last, but by no means least, price. The Oldsmobile and Crestmobile are in a class by themselves. They, like the American steam automobile, are lighter, better and cheaper than anything French shown. It can safely be predicted that the American gasoline vehicles, with their excellent machinery, automatic engines, simplicity of control and ease of riding, will advance to the front rank in the touring and pleasure, as well as the racing class.

Electric vehicles are exhibited by five manufacturers. But the styles shown are more numerous and the uses more varied than those of all other classes combined. The electrics cover all uses that street vehicles can be put to, with the one exception of long-distance touring and racing.

The Fanning Manufacturing Company, of Chicago, exhibited a light runabout of novel construction. It weighs 950 pounds, is neatly painted and trimmed, and is fitted with a Porter battery which, it is claimed, will give a range of from forty to sixty miles.

The Baker Electric Vehicle Company, of Cleveland, showed two of its light runabouts and a very handsome and well-designed stanhope. The Baker runabout was one of the best built, most graceful and desirable vehicles of its class in the show. For use about a city for one or two people or for park riding it is an excellent motor vehicle. Professor S. H. Short purchased one of these runabouts to take to England.



Sperry Rectifier for Automobile Charging.

The American Bicycle Company had a very excellent line in its "Waverly" electric vehicles. Among others it exhibited a runabout, a surrey and a delivery wagon, which are to be particularly commended. The American Bicycle Company uses the Sperry battery, which it owns and makes, in its vehicles. Mr. Sperry, in addition to working out very carefully the electrical equipment, battery and controllers for these wagons, has designed and built a rectifier intended to be used where it is desired to charge batteries from an alternating current. Mr. Sperry's device is said to be much simpler than any rotary converter heretofore built and, if successful, should have a large field of usefulness.

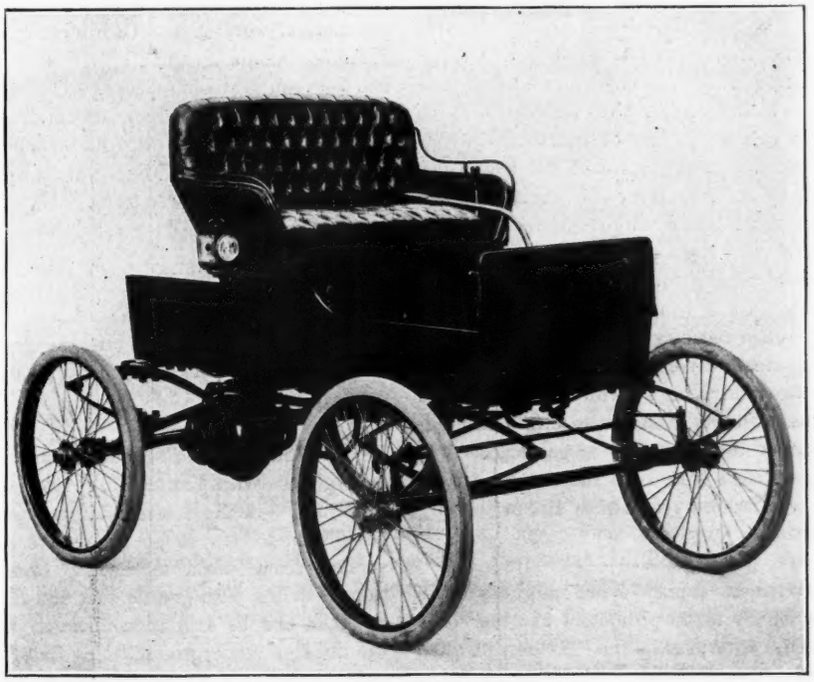
The Vehicle Equipment Company's exhibit attracted much popular attention, due to the spectacular effect of hoisting a large safe to the roof of the building by means of the electric motor-driven winches on the electric-propelled truck made for Hall's Safe Company. This truck is a splendid demonstration of the economy

and adaptability of electric propulsion. The battery furnishes power not only for moving the vehicle but for handling and placing its load. This company has also an electric ambulance, opening at the side instead of the end, and two or three handsome, well designed carriages, as well as delivery wagons.

The Electric Vehicle Company, which has absorbed the Columbia and the Riker companies, had a large and instructive exhibit, mostly of well-known types of apparatus. Perhaps the most notable novelty in this exhibit was an electric vehicle with a Tonneau body, in imitation of the gasoline touring cars.

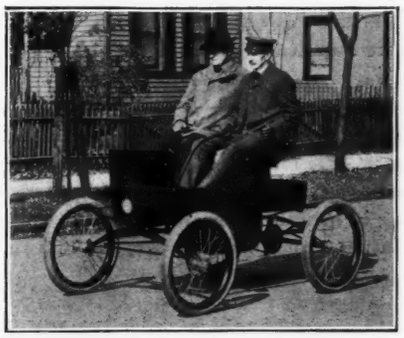
In the gallery were shown many kinds of special electric attachments for vehicles. Storage batteries, dry batteries, portable electric lights, sparking plugs and the like were shown by many makers.

The General Power Company, of New York, showed a combination of kerosene engine and dynamo for charging storage batteries which attracted much attention. Two sizes, one and one-half and four kilowatts, were shown. The outfit is simple, easily managed and, it is claimed, economical. A variation of less than two and one-half per cent in voltage is claimed.



American Bicycle Company's Electric Runabout.

In the loan exhibit, in the annex, was one cell of Mr. Thomas A. Edison's new storage battery. Broadly, it is claimed that at six-tenths the weight it will develop the same or better power, life and efficiency than any battery now on the market. It is a ten-plate cell, made of nickel and iron, weighs seven pounds six ounces; capacity, 120 watt-hours; weight per horse-power-hour, forty-six pounds. The electrolyte is potash. This battery bids fair to advance the use of the storage battery as much as other of Mr. Edison's inventions have advanced other electrical lines.



Baker Electric Runabout.

The show demonstrated conclusively two things of great importance. First, that the public have ceased to look on the automobile as an experiment. It is taken for granted and admitted that "it will go." Second, that the business has passed the experimental stage and is in the hands of active, pushing, financially stable manufacturers. The show pleased the automobilist because he could see and compare all the important makes and styles. It pleased the general public because it gave it a nearer view of the vehicles it has seen heretofore whizzing along the streets, and it pleased the manufacturer because it enabled him to sell many vehicles.

## Views, News and Interviews.

One of the latest uses to which it has been suggested that wireless telegraphy can be put is that of communication between the oases of the Sahara Desert. If this system were used there would be no wires to be stolen.

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They do things differently in Great Britain. The Glasgow Exhibition, which has just closed, has shown a profit of over £100,000. This is one more illustration of the fact that the Scots are the canniest people on the face of the earth.

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Rare presence of mind was displayed recently by the driver of an automobile which took fire in Springfield, Mass. The driver ran the burning machine to the nearest fire house and asked the firemen to extinguish the flames, thus bringing the fire to the firemen instead of the firemen having to go to the fire.

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The shafts of an old mine in Scranton, Pa., are being utilized for a novel purpose. The workmen and engineers of the Lackawanna & Wyoming Valley Rapid Transit Companies are at work opening up the shafts of the old Hurley mine. The new railway will pass through the underground passages of this mine and others which were operated years ago by the Lackawanna Iron and Coal Company.

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It is said that Dr. Jennie Gray, of Toronto, is the first lady physician in Canada to employ an automobile for professional calls. It is an electric vehicle. This vehicle has a hood similar to that on a doctor's buggy, and is provided with an ingenious device consisting of an electric lamp with a cord several yards long for ascertaining the numbers of the houses in dark streets. When she arrives before a house she turns the switch and with the lamp in hand makes sure of the number with no loss of time.

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One of the newest applications of electricity is in making a more convenient faucet than that ordinarily used. A patent on this device has been granted to Mr. Isaac G. Waterman, of Santa Barbara, Cal. The purpose of this device is to control the flow of water to the basins of washstands by means of push-buttons located close to the basin. Two pairs of electromagnets are suspended from the walls, each pair being mounted in such a way as to drive a piston up or down, according to which button is pressed. In this manner the piston opens or closes either the hot or cold valves and allows the water to flow into the bowl.

# News from Great Britain.

(From Our Special Correspondent.)

AT THE first meeting this session of the London County Council electrical matters played a prominent part. Among these it is a relief to find the question of the continual opening of the streets by electric lighting companies and the like—especially in the city itself—has at least been noticed by such a body as the London County Council. More than one death can be indirectly traced to this cause, and the suggestion that the London County Council should make regulations and undertake such supervision as will ensure such work being done expeditiously and with full regard to the public safety and business interest ought to meet with general approbation. Another motion at this meeting was to the effect that clocks, worked by electricity, synchronized hourly from Greenwich and lighted by electricity, should adorn all the principal thoroughfares of London; a move which, if carried into effect, would not confer the proposed benefits before they were necessary at certain important termini in the metropolis. Finally, as an example of the fatherly care with which an unappreciative London is guarded, a resolution was passed to the effect that in view of the extension of underground railways in London, the Health Committee is to report on the condition of the atmosphere in the tube of the Central London Railway.

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If the happy day ever arrives when London becomes possessed of a system of municipally controlled electrically driven clocks, it is to be hoped that our experiences will not be of the kind which have lately fallen to the lot of the Glasgow inhabitants, where such clocks already exist. Altogether there are twelve clocks on two circuits, and the spectacle of a dozen public timepieces persistently pointing to twelve minutes past four at eleven o'clock in the morning was probably enough to make the busy Scot "say things." However, some modifications in the mechanism of these clocks have been tried in the exhibition with such satisfactory results that efforts are being made to immediately substitute the latter for those already in use. Another matter which has attracted public attention in Glasgow is the action of the chief of the fire brigade in preventing —by means of hose and water—some telephone cables being laid in the streets; the result of a misunderstanding with Mr. A. R. Bennett, the telephone manager, and in which the cable contractor's workmen had the worst of the joke, but who were awarded £12 each a few days afterward in the courts as damages.

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The Post Office has just appointed Mr. G. F. Preston to be general manager of the telephone department. It is interesting to note that this gentleman leaves the National Telephone Company in order to take up this post.

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The month allowed by Parliament to allow the Metropolitan District Railway Company and the Metropolitan Railway Company to decide upon the system to be employed for the electrification of their lines expired last week, and, as no settlement was arrived at, it is left to the Board of Trade to arbitrate. Perhaps the result of this arbitration will leave us with a clearer idea of what is going to take place than has hitherto been the case.

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The first application of Mr. George Westinghouse's gas engine in a metropolitan electric supply works is about to be seen in the opening of the Walthamstow power-house. In spite of the confidence felt by the makers of this engine, we can not blind ourselves to the fact that so many gas-driven stations in England have proved ghastly failures; even an adjoining parish to Walthamstow—*viz.*, Leyton—has only recently discarded this method for steam-driven sets. Dublin, Coatbridge and King's Lynn have all proved unsatisfactory, and the results of the advent of this new type of gas engine will be watched with keen interest by all engineers whose sympathies are in that direction.

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With an energy which might well be copied by other promoters of other electrical enterprises, the London United Tramways Company, notorious as being the first to give London an efficient electric tramway service, is endeavoring to extend its system on a by no means diminutive scale, and so far its efforts can not be said to have been unsuccessful. Its latest proposals include districts some 15 to 20 miles from town.

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The gas journals on this side, which even now refuse to recognize electric lighting as a serious competitor, and which never miss an opportunity of informing us that we are going to the dogs, are afforded one more chuckle over the Glasgow corporation electricity accounts up to May 31 last—which have just been published—and by which it is seen that a loss of over £4,500 has been incurred. The details are as follows: Gross revenue, £79,499 14s. 11d.; working expenditure, £46,647 4s. 11d.; interest on loans, £24,547 4s. 3d.; sinking fund, £8,862 19s. 4d.; proportion of cost of supplying lamps, etc., to consumers consequent on the change of pressure from 100 to 250 volts, £4,109 13s. 4d.; total, £83,662 19s. 4d.; deficit, £4,517 6s. 11d. This has been met by drawing on the reserve. This is not due to unsatisfactory working, but to increased interest on loans and to expenditure on mains, etc., in connection with the change of pressure and not yet wholly productive.

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The first application of wireless telegraphy on anything like a large scale for commercial working has been announced, inasmuch as an agreement has been ratified between Marconi's people and Lloyds Shipping Agency, whereby the latter undertakes to use only the Marconi system for fourteen years, and to immediately equip ten Lloyds signaling stations. Sixpence per word is now the fixed tariff for wireless messages between ship and ship or a ship and land, but in the case of messages exchanged between an outward bound vessel and a homeward bound one, the charge is one shilling per word; land charges extra in both cases.

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The British Westinghouse Company, having secured a controlling interest—financially—in the Mersey Railway Company with a view to an immediate conversion from steam to electric locomotion, is acting with greater tact and facility than can be said in connection with the London "underground." By its agreement with the Mersey directors the Westinghouse company undertakes to provide the plant necessary to enable the traffic to be worked electrically within eighteen months from July 15 last, and to undertake certain financial obligations, such as the guaranteeing of interest, etc., for a contract price of £635,303, of which £620,000 will be taken in four per cent new first perpetual debenture stock, and the remainder in cash. This particular railway company has not been in a greatly flourishing condition for some time past;

indeed, it is only since the above agreement has developed that a receivership and managership under order of the high courts have been withdrawn. Messrs. Westinghouse's confidence in the success of the undertaking is emphasized by the magnitude of the risk they are prepared to run, and judging by precedent one fails to see any reason why this confidence should prove to be misplaced.

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*Apropos* of our London Metropolitan controversy, I mentioned a short time ago that the question of the most suitable system would have to be settled by a Board of Trade arbitrator if the opposing interests could arrive at no agreement within a month from about July 15. No such mutuality developed, however, and accordingly the Hon. Alfred Lyttelton, K. C., M. P., was appointed to undertake the by no means enviable task. Eminent counsel has been retained on both sides—if possible, Mr. Yerkes having a slight advantage—and the arbitration appears to be going to carry itself to some length. A first sitting was held a fortnight ago, but although Mr. Yerkes's company and counsel were eager to proceed forthwith, the Metropolitan company, the advocate of Messrs. Ganz's high-pressure system, obtained a three weeks' adjournment in order to more completely materialize its evidence. The contest, which will thus start in real earnest on the twenty-ninth instant, should prove of immense interest and produce some entertaining engineering details, at the same time, I fear, reflecting but little *kudos* on either of the companies. A fairly general opinion would appear to be that the whole question could have been solved minus the inevitable heavy expense appertaining to government arbitrations, which, presumably, the unfortunate shareholders will have to bear uncomplainingly.

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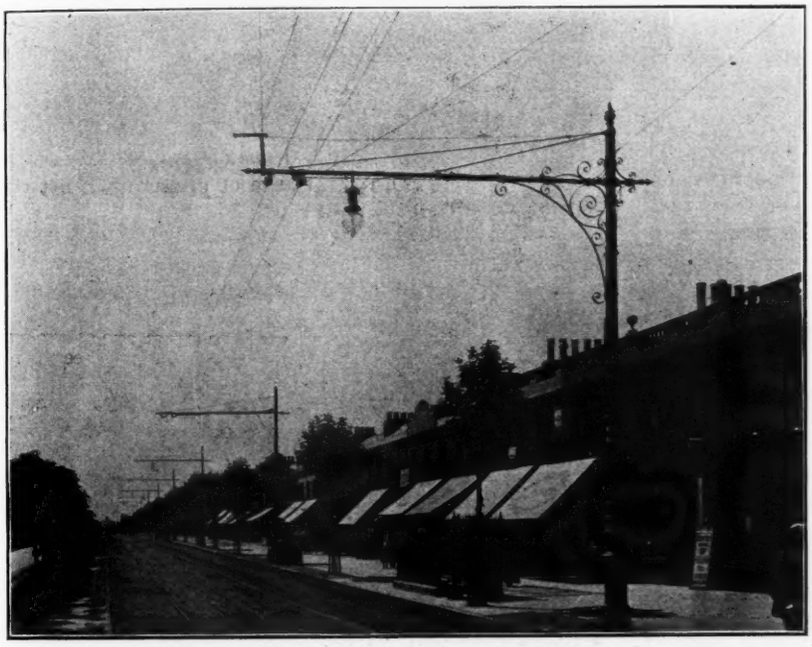
The East Ham (London) electric light and traction system and the Portsmouth electric tramways, both of which have been recently inaugurated, afford specimens of the few examples of British installations equipped solely with British plant. At Portsmouth, the total capital expenditure so far has been something like £300,000, and, as at Glasgow and some few other places, the lighting and traction generating plants are in separate buildings. The organizers of the traction movement in Portsmouth are congratulating themselves on having created a record for track laying, as since the end of February this year they have been laying, completely finished, track at a rate of about one mile per week. Messrs. Dick, Kerr & Company deserve credit for this installation, which is laid out on standard lines.



Trolley Wiring and Street Lighting in East Ham.

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At East Ham current is fed to both the lighting and traction circuits from the same power-house, and the combined capital expenditure (at present some £90,000) will eventually be some £140,000. The generators—of which there are four, having an aggregate output of 760 kilowatts—are multipolar machines, having slotted, drum-wound armatures. They work as compound-wound generators with a variation of from 500 to 550 volts when used for traction purposes, and running as shunt-wound dynamos for lighting. A rheostat is provided to enable the pressure to be varied between 480 and 580 volts. A feature of this tramway system is the introduction of halfpenny fares, a step which has been taken with a view to popularizing this method of transportation. As at Portsmouth the whole of the equipment follows the standard practice here, but the introduction of a new type of enclosed arc lamp on the lighting circuit calls for comment. This lamp, which has only quite recently been introduced by Messrs. Johnson & Phillips, contains no upper carbon holder, contact being made direct onto the carbon. The contact device consists of four pieces of copper of special section, which are connected by pins to the contact frame. There are no springs or similar contrivances, the contact pieces merely resting against the positive carbon by gravity. At East Ham the lamps are placed on alternate trolley poles, and by suspending them from the cross-arms of the standards in this way, it is estimated that a saving of from £3,500 and £4,000 has been effected on the installation. It is interesting to note that no vibration is noticeable through the lamps being suspended in this position. The illustration gives a typical view of the tramway construction and the arc lamps.

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Next session a bill will come before Parliament seeking the necessary power to construct an electric express railway between London and Brighton, upon which the trains will travel at about ninety miles per hour, thus reducing the time at present taken by the steam "expresses" to about one-third—*viz.*, half an hour—together with a still greater decrease in the fare. I believe that Mr. H. F. Parshall has some connection with the project, and the line, which will be partly in tunnel and the remainder on the surface, will be operated from a generating station, containing some 10,000 horse-power, situated at Redhill, about midway between the termini. If the scheme ever materializes it is safe to prophesy its complete triumph over the prevailing means of communication. Many business men live at Brighton, which is about fifty miles out of London on the south coast, and it is a generally accepted truth that this part of the kingdom is one of the worst—if not the worst—served so far as railway accommodation is concerned; a run up to town in half an hour would be a boon.

London, October 30. A. W.

### Good Export Business.

Mr. James A. Myers, president of the Robbins & Myers Company, of Springfield, Ohio, is now in Europe looking after the export business of this company. They are large exporters of fans and have also been exporting a great many dynamos and motors. The foreign demand for their product is increasing so rapidly that it was found necessary for a representative to go abroad and close contracts for the coming season.

This company has been engaged in the manufacture of dynamos and motors and the well-known "Standard" ceiling, desk and bracket fans since 1897. They confine themselves to small units, the dynamos ranging in sizes from one-quarter kilowatt to ten kilowatts, and motors from one-sixteenth horse-power to twelve and one-half horse-power, their entire electrical line being for direct-current circuits.

Soon after starting the manufacture of fans they added their line of dynamos and motors. For three years they manufactured these goods on the third floor of their foundry machine shop, this floor having 3,400 square feet. This business assumed such proportions that it was found necessary to seek larger quarters. It was then that they added a three-story brick building of 31,000 square feet of floor space, used exclusively for the manufacture of fans and dynamos and motors. This factory is foremost in equipment for the manufacture of fans and motors, being provided with the latest tools and machinery obtainable, many of the special tools and winding machines having been constructed by experts in the employ of the company, these special tools and machines enabling the company to turn out their goods on an unusually economical basis. The plant has first-class railroad facilities, and is one of the best lighted and heated factories in the world, the heating being effected by the hot-air system.

The first floor is used for machine room, tool room, engine room, plating room and offices; the second floor for the building of fans and motors, and the third floor for storage and packing.

This firm started in a small way twenty-three years ago in the gray iron foundry business. To-day they have one of the best equipped light gray iron jobbing foundries in Ohio, having a daily capacity of thirty-five tons. The foundries have 37,000 square feet of moulding floor space, and accommodate 130 moulders. The four-story machine shop, used for repairs and setting up work, has 13,600 square feet of floor space.

The cleaning rooms are equipped with friction rattlers and dust exhausters of the company's own make. The entire plant covers three acres of ground.

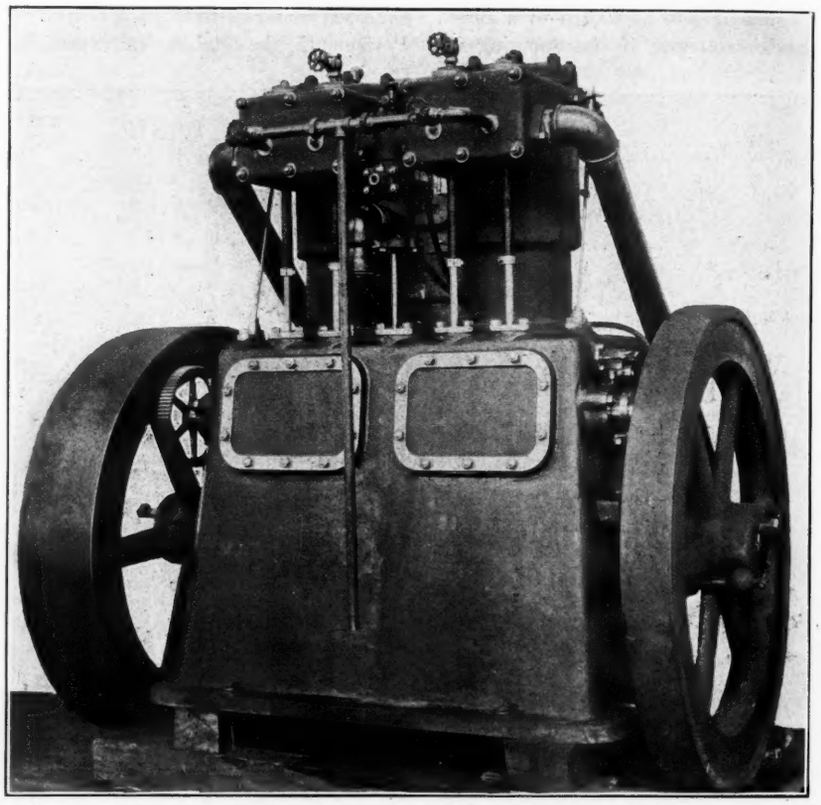
### A New Type of Gas or Gasoline Engines.

The accompanying illustration shows a new type of vertical multiple cylinder gas or gasoline engine, manufactured by the Maywood Foundry and Machine Company, Maywood, Ill.

In general design the engine is of the enclosed type, in which the crank-shaft, cams, cam-shaft, rocker-shaft, connecting-rods and all the main bearings and working parts are enclosed in an oil-tight case and run in a bath of oil, which furnishes lubrication to all parts, including the cylinders and pistons. The two front doors on the engine give access to all of the auxiliary moving parts, while the rear doors allow the main bearings to be easily gotten at. The pistons are provided with five spring-rings and are very large and substantial. The tops of the pistons are so arranged as to be removable for adjustment of the wrist-pin bearings without the necessity of taking the pistons out of the cylinders. The cylinders are, of course, water-jacketed, and the valve chests are so designed that worn valve seats can be bored out and rebushed. The valves are of the direct-acting poppet type, the igniters being operated by hardened steel cams on the cam-shaft. Platinum-iridium points are used and are claimed to be very durable. Ignition current is obtained in the usual way from a battery and spark coil or direct from a dynamo. Both ribs and hubs of the flywheels are turned, making the latter run very steady, while very heavy gearing is used between the crank-shaft and the cam movement.

The governor, which is, in a way, the most important and essential feature of a gas engine, is of the throttling type, and on a two-cylinder engine permits one charge to be ignited for every revolution. The amount of fuel admitted to the cylinders and the force of the impulse are closely proportioned to the requirements of the load, and it is claimed that exceedingly uniform speed in operation is attained. The governor is, as shown in the illustration, of the flywheel type, and acts directly by means of a lever and rod on the mixing-chamber valve, by which both the air and gas are admitted in definite and proper proportions to the cylinders. It is claimed by the makers that this method of operation is greatly superior to the "hit or miss" system of governing, especially when the engine is direct-coupled or belted with electrical machinery. An interesting feature of this governor mechanism is the ability to regulate the speed of the engine while running. This can be done by turning a small thumb screw on the governor rod, which increases or decreases the tension of the governor spring, and allows a variation of as much as fifty revolutions per minute. In case of a temporary overload this feature is very valuable.

Either gas or gasoline may be used in these engines, which are furnished, if desired, with inlets for both combustibles. The engines are made in a large number of sizes for various purposes.



A New Type of Gas or Gasoline Engine.

### Special Types of Enclosed Direct-Current Motors.

The accompanying illustrations show several interesting types of motors which have recently been brought out by the Milwaukee Electric Company, Milwaukee, Wis.

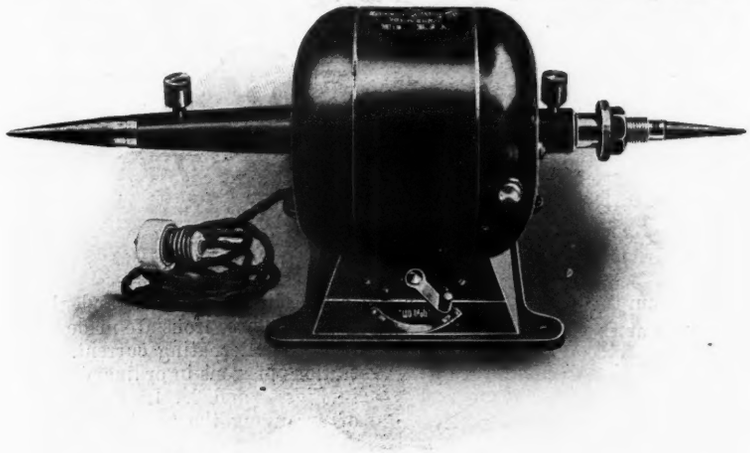


FIG. 1.—BUFFING WHEEL MOTOR.

Among the very first applications of the electric motor was in connection with polishing lathes and buffing wheels. The type of motor shown in Fig. 1 is intended for operating such tools, which are directly mounted upon its shaft, thus obviating all necessity for belts and leaving no place for the accumulation of dirt and dust. At the same time a high economy in floor space is attained. These motors are made in sizes from one-quarter to three horse-power with speeds of from 1,800 to 3,000 revolutions per minute, and are provided with speed regulators as is clearly shown in the illustration.

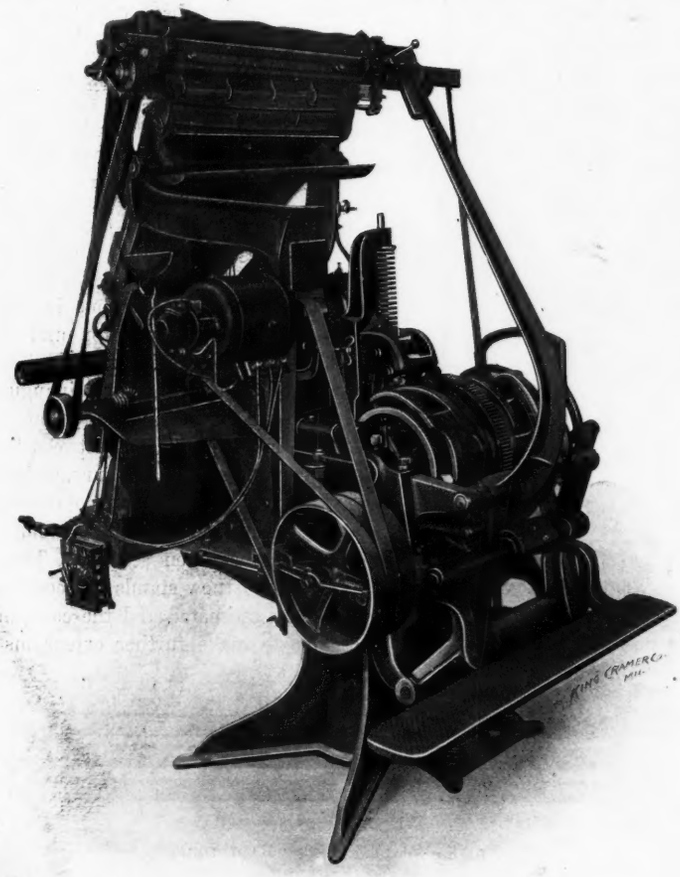


FIG. 2.—LINOTYPE MOTOR.

Fig. 2 exhibits an interesting application of the motor to a linotype typesetting machine. The manufacturers have made an exhaustive study of this particular application of the motor and have devised a type that will stand the usage of the printing office and at the same time be out of the way in an easily accessible position on the back of the machine. A particular feature claimed for this motor is its noiseless operation.

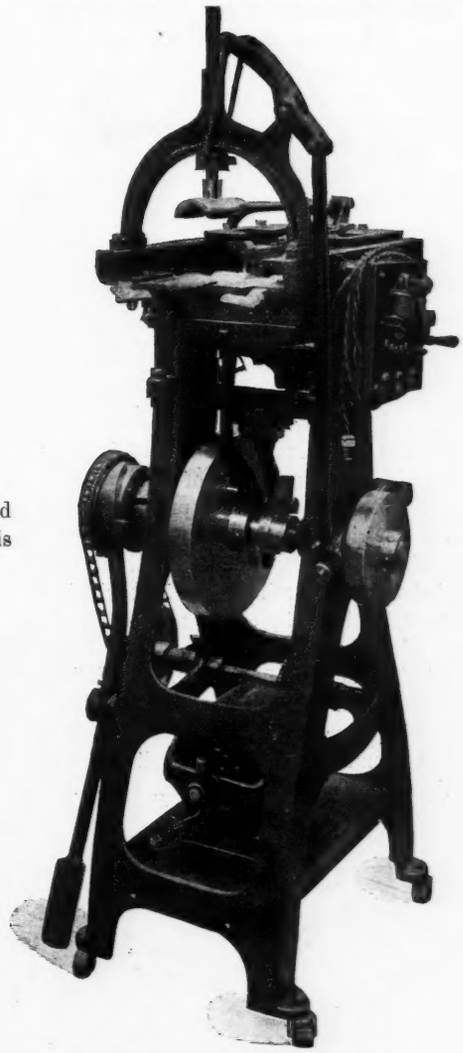


FIG. 3.—MOTOR GEARED TO BOTTLING MACHINE.

In Fig. 3 is shown another interesting application of a rather slow-speed type of enclosed motor direct-geared to a bottling machine. This motor is provided with rheostatic speed control and a limiting switch, as is shown on the right of the machine, and owing to its mounting inside the frame of the machine does not increase the floor space of the apparatus to any degree. It will be noticed that this application is an interesting example of the self-contained electric-driven unit, the machine being mounted on castors, and adapted to being moved about wherever desired.

The company also makes a large number of other motors for special applications, the enclosed dustproof type being adhered to in the majority of them.

### Electric Heating.

Of the many applications of electricity in the household and factory, there are few which commend themselves more as a help to the workers than the heating effects of the current when applied to hand tools, laundry or pressing irons, and machine irons of special design. The fact that electric heat can be developed and concentrated directly where it is required,

FIG. 1.—TAILOR'S GOOSE.

without the usual great loss of heat by the old methods, permits of its economical use, notwithstanding the present cost of the electric current.

From this standpoint it will be seen that wherever localized heat is required in the arts, electricity can be more efficiently applied than any other method. Electrically heated irons are found particularly serviceable in millinery, cloak and dressmaking departments, hat factories, clothing manufactories and are well suited to the requirements of merchant tailors.

FIG. 2.—PRESSING IRON.

A large line of electrically heated irons is manufactured by the McCay Engineering Company, of Baltimore, Md. This company claims for these irons a number of advantages. The same iron may be used continuously, there is no flame in the iron, and no heating fuel is necessary, which reduces the risk of fire. As the entire heating power of the current is concentrated close to the working face of the iron, but a small percentage of the energy is wasted. It is thoroughly protected from an excess of current by a proportioned safety fuse which controls the current readily. With an electrically heated iron it is possible to obtain cleanliness and entire freedom from the unhealthy products of combustion.

The cost of operating a small iron is said to vary from two to two and one-half cents per hour at the usual rates charged by central stations. All the details of the construction of the iron have been carefully worked out with a view to making the necessary renewal of terminals as inexpensive as possible. Much time and experiment have been devoted to the development of this line of apparatus, and hence it is possible to tell about what the irons will do. A double-pole switch is manufactured to go with the irons to show whether the current is on or off; also a porcelain covered main-line vertical, all mounted on a single base of slate ready to connect to the lighting mains and the iron or heater. These irons are made for both direct and alternating current. Two illustrations of irons in ordinary use are given in Figs. 1 and 2. In Fig. 3 the method of arranging the heating coils is shown.

FIG. 3.—METHOD OF ARRANGING HEATING COILS.

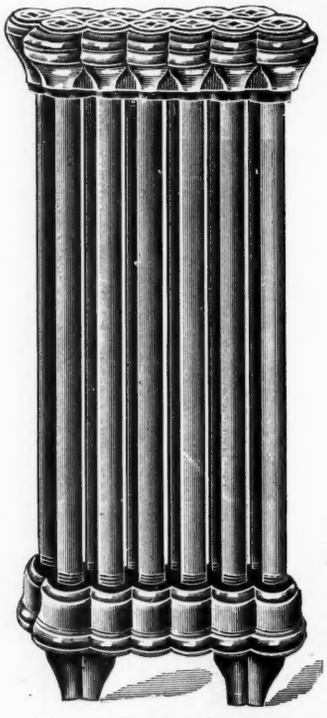


FIG. 4.—ELECTRIC RADIATOR.

This company also manufactures electric radiators suitable for heating bath rooms and small offices, and any place where an electric heater can be used. They are constructed of one and one-quarter-inch steam pipe, and are identical in appearance with ordinary steam radiators. These heaters have been put to a severe test, and it is claimed that their life is practically indefinite. This style of heater is shown in Fig. 4. In Fig. 5 the wall form of radiator is depicted. It is made to be placed against a wall, and is a very convenient form wherever it is desirable to economize space.

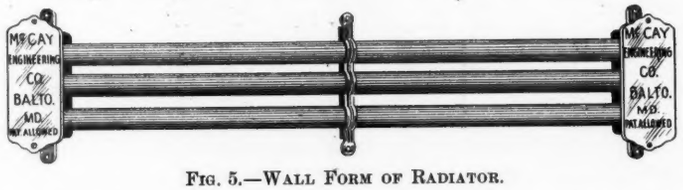



FIG. 5.—WALL FORM OF RADIATOR.

Engineer Kimball is reported to have said regarding the Boston Elevated Railway: The work of lengthening the platforms at the stations in the subway is now being carried on and should be finished within a short time. This should be followed by the early inauguration of four-car trains on the elevated system. The half-mile stretch between Guild and Townsend streets, Roxbury, which the road has received authority to construct, will not be built until next year and after new capital has been secured. The elevated road as it now stands has cost more than it was estimated and the company is unable to make further extensions until it has secured additional funds. Steps have already been taken preparatory to petitioning the railroad commissioners for authority to issue new stock.

### Storage Batteries in an Isolated Plant.

In the Astor Building, in Wall street, New York city, there has recently been installed a very handsome isolated plant in which use is made of storage batteries. The accompanying illustrations show in some detail the generators, the battery room and some load diagrams illustrating the advantages of storage batteries in this connection.

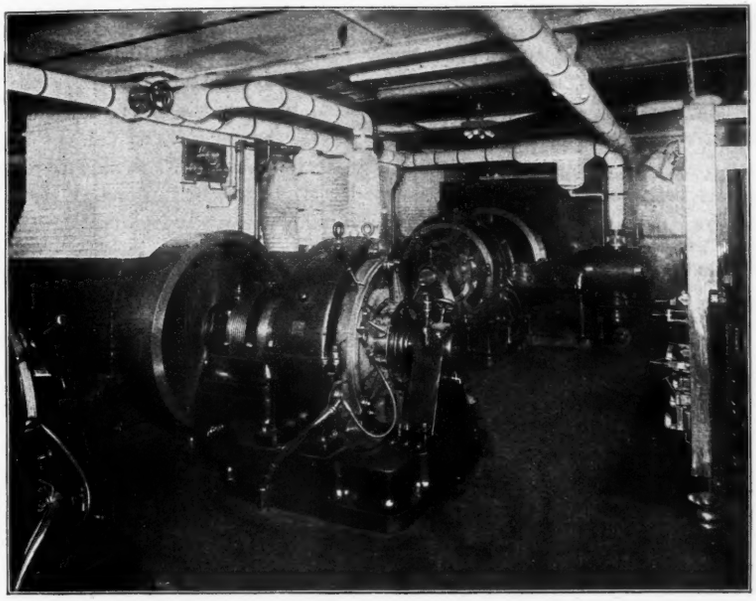


FIG. 1.—THE ENGINES AND GENERATORS.

Current is supplied for the building from three direct-driven dynamo units working in connection with a battery of sixty chloride cells having a capacity of 200 amperes at the normal discharge rate.

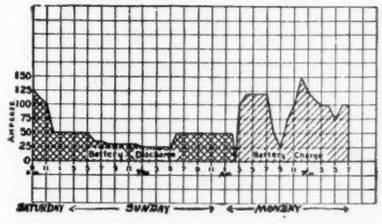



DIAGRAM 2.

These cells are capable, for a short period and in case of an emergency, of supplying a much larger amount of current. In all, the generating plant comprises 200 kilowatts capacity, and is used for lighting purposes only, the elevators in this building being of the hydraulic type. In order, however, that the elevator service may not be interrupted, a set of electrically driven pumps has been installed capable of operating one elevator when the steam pumping plant is shut down. Current for this purpose is supplied from the battery.

The load diagrams which are here shown give a comprehensive presentation of the conditions, and show the total plant load as well as the amount of current supplied to the building from the battery. In diagram No. 1 is shown the operation of the plant from the time of its starting, at four o'clock A. M., for any working day of twenty-four hours. The largest amount of current is delivered to the battery during the early morning hours, when the lighting load is small and decreased proportionately with the increase of the lighting load. The generating plant is ordinarily shut down at eight o'clock P. M., and the entire house load thrown on the battery until four o'clock the following morning.

Diagram No. 2 represents the battery discharge extending over the long period included between nine P. M. Saturday and three A. M. of the following Monday. During this long period the generating plant

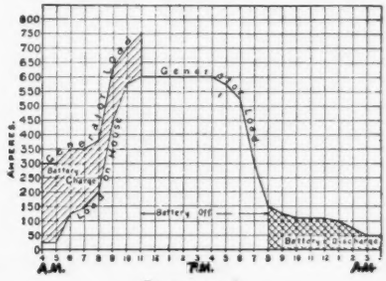



DIAGRAM 1.

is entirely out of operation, the only difference from ordinary conditions being that it is run an hour later Saturday and started an hour earlier on Monday morning. The battery installation was put in by the Electric Storage Battery Company, Philadelphia, manufacturer of the chloride type of cells which are used in it.

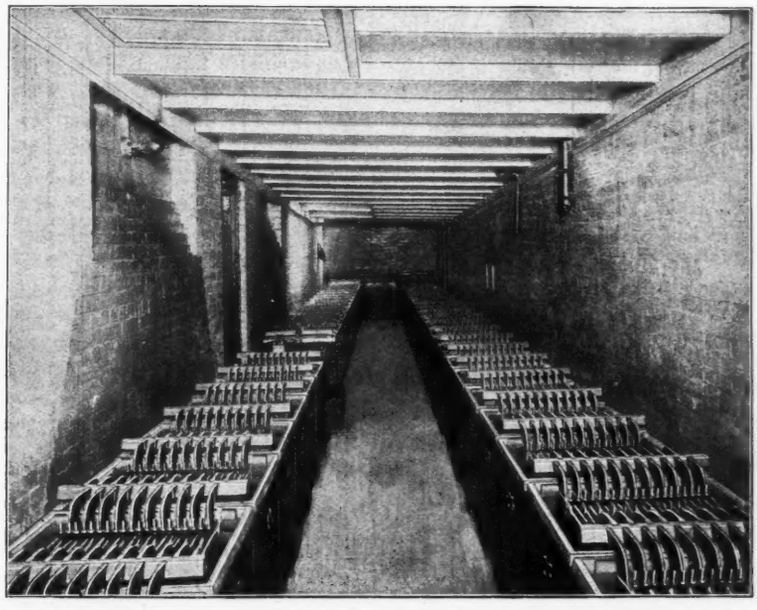


FIG. 2.—STORAGE BATTERY IN THE ASTOR COURT BUILDING.

### Gloves for Protecting Electricians.

In France a process for making protective gloves for electricians has been patented. The material is soaked on one side with rectified petroleum deodorized by oil of lavender, and on the other with solution of india-rubber. The gloves, etc., are then dried, first for five minutes in a stove at a temperature of fifty to sixty degrees centigrade, and then in a cool, shady room. The petroleum side is then painted with a mixture obtained by heating two pounds of linseed oil with three pounds of nitric acid for four hours, and the india-rubber side is dusted over with a powder consisting of equal weights of asbestos and talc.

# Chicago Electrical Notes.

**News of the Industry in the Western Field.**

**(By Our Special Correspondent.)**

FOR MANY years woman's connection with the telephone industry in this country has been almost exclusively confined to the work of the "hello girl" and the making of certain parts of telephones in the factories. Mrs. Anney McElroy Brett, of El Paso, Tex., believes that the management of telephone exchanges comes within woman's sphere, and her work seems to be conclusive proof that her contention is just. Mrs. Brett has been in Chicago this week, her purpose being to purchase switchboards and instruments to equip and operate an exchange of 1,500 telephones. She is president of the Southern Independent Telephone and Telegraph Company, of El Paso, and also president and general manager of the Brett Telegraph and Telephone Construction Company, of the same city. Two years ago Mr. R. A. Brett, who was engaged in the independent telephone field in Texas, died, and his widow immediately took upon herself the responsibility of completing his work. She has been successful, and the company of which she is the official head, after giving the people of El Paso a telephone rate of $20 a year for residences and $30 for business houses, now proposes to extend its lines to Deming, N. M., a distance of eighty miles. In the end the Brett company proposes to complete the line to San Antonio, 600 miles distant.

Judge Tuley last week heard the arguments in the injunction proceedings of the Illinois Manufacturers' Association against the Chicago Telephone Company to restrain the company from cutting off the association's telephone service. The bill of injunction alleges that the telephone company has violated the city ordinance, which fixes the maximum charge for telephone service at $125 per annum. The telephone company has advanced its rate to $175 per annum to cover the cost of the improved service which is given through the new metallic circuit. This the association contends it had no right to do. The case is of great local interest.

Receiver Charles Henrotin, of the Chicago Electric Traction Company, has filed a report for the quarter ending September 30 in the United States Circuit Court, which shows that the company has accumulated a surplus of $11,173 in the operation of the road during that period. This showing is a very satisfactory one, inasmuch as the road, up to a year ago, was losing money to such an extent as to require a receiver. This line was originally operated by storage battery system, but about twelve months ago the trolley system was installed.

A fire in the club rooms of the Technical Club, of Chicago, on the evening of October 23 destroyed the redeemed bonds of the club; it was part of the celebration which marked the club's emancipation from debt. The organization is now in fine condition in every way. Mr. Alfred Noble is president of the club, Mr. Isham Randolph, treasurer, and Mr. W. H. Edgar, secretary.

The Chicago Edison Company is making extensive improvements in its power plants in this city by the installation of powerful machinery and by enlarging some of its buildings. The company has also secured a number of large contracts in this city. Marshall Field & Company have awarded it the contract for wiring the new twelve-story addition to the Field retail store. This is one of the largest contracts ever given in this country and will require more than 300,000 feet of wiring and conduits for 22,000 incandescent lamps, and fan and elevator motors amounting to 1,000 horse-power. This contract calls for the expenditure of $80,000. The Chicago Edison Company will also wire the new building of the Chicago *Tribune* and furnish it with light and power for a number of years.

Mr. Geo. F. Harding, Jr., of Chicago, has filed a bill in the Superior Court against the Chicago City Railway Company, in which he alleges that the stockholders of the company are attempting to secure an extension of franchises without paying the value of the same to the city. The bill is sensational in that it charges the officials of the railway company with bribe-giving and propounds a number of questions which it asks the court to compel the company to answer.

Preparations are already being made for the automobile show which will be held in the Coliseum, in Chicago, next March. The first allotment of space will be made by the advisory board on November 15. The board consists of G. H. Atkin, Electric Vehicle Company; C. H. Tucker, Locomobile Company, and L. M. Grout, of the De Dion-Bouton Company.

The Chicago Automobile Club is arranging to cooperate with the show officials so as to make the spring event a greater success than ever. The club now numbers ninety-eight. F. C. Donald is president, H. M. Brinkerhoff, secretary, and B. C. Buxton, treasurer.

At Clyde, Ill., last Saturday, a public test of the Farnham third-rail system was made in the presence of a number of railway representatives and engineers from different parts of the country. Mr. Farnham claims for his system that it is applicable to trunk lines as well as city and suburban lines of railway. A half mile of track had been equipped near Clyde and a heavy trolley car provided. On this line the visitors were given a ride and the car was operated in such a manner as to show the working of the switch and shoes. The third rail used was enclosed in a wooden box, about three feet above the track level. Mr Farnham showed that accidents would largely be eliminated by his system, inasmuch as all sections of the line remain dead except the section on which the car is operating. Engineers who witnessed the test expressed themselves as pleased with what they saw, though they were unable to say, without further study of the system, what its possibilities might be.

Officials of the Aurora, Elgin & Chicago Railway Company are pushing the construction of their lines with a view to having them in operation before the close of spring. The entire system will be laid with 80-pound rails, heavily ballasted with gravel and with few grades above one per cent. The construction of the road will be that of a heavy steam railroad, as it is the purpose of the company to secure high speed and to haul heavy loads. In fact, it is affirmed by some of the officials that it is their purpose to give the patrons of the road as fast a service as the steam lines with which it competes. The third-rail system will be installed and it is believed that a speed of fifty or sixty miles an hour can be secured. In order to lessen the danger from accidents it is proposed to fence in the right of way along the entire route.

Chicago, November 7.

# CURRENT ELECTRICAL NEWS

## COMMERCIAL NEWS

### DOMESTIC AND EXPORT

LONG MEXICAN ELECTRIC LINE—An electric railway is to be constructed from Tuxpan to Mexico City. It will pass through Hidalgo and Pueblo.

LARGE BORING MILL—The foundations for a large boring mill are being laid by the General Electric Company in Schenectady, N. Y. It is to swing sixty feet.

CLEVELAND ELECTRIC RAILWAY—It is reported that five prominent men have signed an agreement pledging $1,115,000 to build two street railways in Cleveland, Ohio, to be operated on a three-cent fare and with universal transfers.

CANAL LIGHTED BY ELECTRICITY—The Cornwall Canal is now lighted by the St. Lawrence Electric Power Company. About 250 lights are used for this purpose. They are placed 300 feet apart, with from six to thirteen at each lock.

ELECTRIC TRAMWAYS IN A MINE—A system of electric tramways is to be installed in two levels of the Quincy mine at Hancock, Mich. The outfit consists of two electric locomotives, steel tram cars, motor generator, and material for the wiring of the mine.

WYOMING POWER PLANT—Messrs. William F. Cody and Nate Salsbury, and some eastern capitalists, are interested in a power plant and irrigation canal, which will be forty-five miles long, for the purpose of irrigating 100,000 acres of land near Cody, Wyo.

PORTO RICAN ELECTRIC RAILWAY—An electric railway is to be constructed from Mayaguez to San Juan. A company of engineers has been inspecting the line and has decided to continue it to Yauco. This will fill in the gap between Ponce and Mayaguez.

LONDON RAILWAY DEVELOPMENTS—It is reported that Mr. Charles T. Yerkes has testified before the arbitrator appointed to decide on the electrical system for the underground railroads that he will not be connected with any but the direct-current system which is almost universally used in the United States.

CANADIAN ELECTRIC RAILWAY—Ex-Mayor Carson, of Kingston, is interested in the building of an electric railway from Toronto to Cornwall. An application for a charter will be made to the Ontario Government at the coming session of the legislature. To build the railway $5,000,000 will be required.

ELECTRIC PUMPING STATION FOR THE NAVY YARD—The plans are now being completed for the proposed dry dock No. 4 at the Brooklyn Navy Yard. This dock is to have a pumping plant which is to be situated in the bottom of the caisson and operated by electricity. The power station is to be situated some distance from the dock.

PACIFIC CABLE A NECESSITY—General Greeley, who is the chief signal officer, stated in his annual report that the American transpacific cable was a military and commercial necessity to safeguard the American interests in the Asiatic possessions. Such a cable would also foster industrial interests and facilitate commercial operations.

RAILWAY TO BE EQUIPPED WITH ELECTRIC SIGNALS—It is announced that the Pittsburgh & Lake Erie Railroad will be equipped with automatic electric block signals. The Union Switch and Signal Company, of Pittsburgh, has received the contract for equipping the portion of the line between Youngstown, Ohio, and Glassport. The storage battery plan has been adopted.

WATER-POWER PRIVILEGE CHANGES HANDS—The Little Falls water power at Little Falls, Minn., is said to have passed into the hands of a number of capitalists who represent the Westinghouse Electric Company. The new company states that work will soon be commenced upon the construction of a large plant for the manufacture of machinery used by the Westinghouse company in its western trade.

NEW CLEVELAND COMPANY—The Electrograph Company of America has been formed for the transmission of pictures and facsimile writings by electricity. The company has a capital stock of $1,000,000, and is incorporated under the laws of Delaware. Mr. H. R. Palmer, an electrical engineer of Cleveland, invented the electrograph. The United States and Canadian patents on the invention have been sold to the Electrograph Company of America by the International Electrograph Company of Cleveland. Mr. C. R. Huntley, of Buffalo, is a director.

MEXICAN ELECTRIC LIGHTING COMPANY CHANGES HANDS—Messrs. C. R. Bucheit, T. M. Barnstall and E. W. Davis, of Pittsburgh, Pa., are said to have purchased the traction and electric lighting interests in El Paso, Tex., and Juarez, Mex. A company, to be known as the El Paso Electric Light Company, with a capital stock of $1,250,000, is being formed. It is expected that traction and lighting interests in that vicinity will be united and that eventually a common company with a capital of $4,000,000 will be formed.

ELECTRIC POWER USED FOR WATER SUPPLY—Mr. Warren H. Loss, of New York, who is the contractor for the construction work for the water supply for the city of Mexico, states that the actual details of the work and particulars as to the exact requirements in the way of electrical machinery, waterwheels, pumping equipment, etc., will not be determined until after the engineering experts have returned from Mexico. Upon this plant $6,000,000 is to be expended in furnishing a 40,000,000-gallon daily water supply for the city of Mexico.

RAILWAY INVESTIGATING THE ADVANTAGES OF ELECTRICAL EQUIPMENT—It is said that estimates are being made by several electric companies showing the cost of equipping the Putnam division of the New York Central Railroad with electricity. The plan is said to be to adopt the same system as the Manhattan Elevated Railroad if that equipment works satisfactorily. It is stated that it is the intention to run Manhattan trains over the Putnam division of the New York Central Railway and thus establish a through service from Rector street, on the Battery, to Yonkers.

NEW WATER POWER PLANT—The water power which lies between Columbus, Ga., and West Point, which it is said amounts to about 1,000,000 horse-power at the lowest stages of the water, is now being taken up by various individuals. A short time ago an electric power plant was put in operation at Columbus, which brought 8,000 horsepower into use. One thousand acres of land and 12,000 horse-power have now been acquired by Messrs. Stone & Webster, of Boston. Options on adjoining lands and water lots have been secured, and it is announced that the company will expend $1,000,000 in developing the water power and improving the property. Mr. George J. Baldwin, of Savannah, Ga., is the southern representative of Messrs. Stone & Webster.

## TELEPHONE AND TELEGRAPH

ERIE, PA.—The work of constructing a telephone line to Le Boeuf has been begun.

WASHINGTON, IND.—The Independent Telephone Company has received a franchise from the city council.

RALEIGH, N. C.—Extensive improvements in its plant are soon to be made by the Interstate Telephone Company.

BANCROFT, MICH.—A representative of the Union Telephone Company has arranged to put in an exchange at Bancroft.

GANN VALLEY, S. D.—A large force of men is engaged in constructing the telephone line between Gann Valley and Kimball.

ELKINS, W. VA.—The Consolidated Telephone Company has purchased the Woodford line which is operated in Barbour, Tucker and Randolph counties.

TOLEDO, OHIO—The contract for the construction of the telephone exchange building for the Home Telephone Company has been let to Mr. A. Bentley.

BELLEFONTAINE, OHIO—The Bellefontaine Telephone Company has been granted a permit to increase its capital stock by the Secretary of State from $50,000 to $75,000.

BRIDGETON, N. J.—The Interstate Telephone Company is about to make extensive improvements in its telephone system. It is said that the system is to be practically reconstructed.

HAGERSTOWN, MD.—The Maryland Telephone Company has been granted permission by the county commissioners to extend its system from Roxbury to Lappans and other points in the country.

COOPERSTOWN, N. Y.—The construction of a telephone line from Richfield Springs to Cooperstown has been begun under the direction of Mr. F. C. Ward, who represents the new telephone company.

BATTLE CREEK, MICH.—The Citizens' Telephone Company, of Grand Rapids, has absorbed the Calhoun County Telephone Company. Mr. C. F. Rood has been elected president of the new company.

KANSAS CITY, MO.—The Missouri & Kansas Telephone Company is making extensive changes in its plant. The instruments formerly used will be done away with entirely and new ones put in their place.

MCKEESPORT, PA.—It is reported that the Federal Telephone Company, which recently purchased the McKeesport Telephone Company's line at McKeesport and the Pittsburgh & Allegheny Telephone Company, will consolidate its lines in McKeesport.

UNIONTOWN, PA.—A telephone line is being constructed through the Klondike region to afford connection by the H. C. Frick Company with the works and stores of the Federal Steel Company, the National Steel Company and the American Steel and Wire Company.

PASSAIC, N. J.—At a meeting of the Paterson, Passaic & Suburban Telephone Company and representatives of the Interstate Company, a bond issue of $200,000 was authorized, which will be spent in improvements in Passaic and Paterson. A large building will be erected in Paterson. A building is also to be constructed in Passaic, which will not be quite as large as the one in Paterson.

## ELECTRIC RAILWAYS

### ALABAMA

BIRMINGHAM, ALA.—The Birmingham Belt Railway, a line which encircles most of the industries about the city, has passed into the control of the Railway and Construction Improvement Company of New Jersey.

### CALIFORNIA

PASADENA, CAL.—The work of grading on the Pasadena Electric Short Line has been completed and the laying of the rails begun.

### GEORGIA

DAHLONEGA, GA.—An electric power plant is being constructed upon the Chestatee River for the railway which is to be constructed.

### ILLINOIS

GERMANTOWN, ILL.—A twenty-one-year franchise for an electric railway has been granted to Mr. Charles M. McCabe and others.

QUINCY, ILL.—The street car system will be extended to the new factory district, and it is said that it is practically settled to extend it to the Soldiers' Home.

### INDIANA

WABASH, IND.—Work has been begun upon an electric line between Rochester and Wabash.

FORT WAYNE, IND.—The Lima & Fort Wayne Traction Company has accepted the franchise which was granted to it by the officials of Allen County.

### LOUISIANA

NEW ORLEANS, LA.—The franchise of the Orleans Railroad Company has been bought by that company. The bid of the company was the only one entered.

### MAINE

BERWICK, ME.—The railroad commissioners have received articles of association for an electric railway to run from Berwick to South Berwick.

### MICHIGAN

JACKSON, MICH.—The Jackson Electric Railway Company has decided to build a line to Jonesville *via* Huron and Hanover.

DETROIT, MICH.—Messrs. J. D. Hawks and S. F. Angus have gained control of the Lansing street railway system. It is reported that the price paid was about $250,000.

WALWORTH, MICH.—The work of surveying for an extension of the Chicago, Hartford & Geneva Lake electric line from Walworth to Mettowee Park has been begun.

DETROIT, MICH.—Mr. Michael Brunn, of Detroit, has been elected president of the Flint, Saginaw & Bay City Railway. The capital stock of this company is $200,000, which has been paid in.

DETROIT, MICH.—News comes that the Detroit Construction Company has completed the surveys of two routes between Detroit and Lansing and will soon make a choice between them and begin the work of construction.

KALAMAZOO, MICH.—A mortgage for $2,500,000 has been filed with the Knickerbocker Trust Company, of New York, by the West Michigan Traction Company, which is about to build an electric line from Kalamazoo to Benton.

### MISSOURI

KANSAS CITY, MO.—A franchise for a double-track railway to extend from the city along the levee is being sought by the Union Depot Bridge and Terminal Company.

ST. LOUIS, MO.—Messrs. Charles C. Carroll and D. V. Powell have sold the electric railway on the Eads Bridge across the Mississippi River to capitalists from St. Louis and other cities.

### NEW JERSEY

TRENTON, N. J.—The capital stock of the Camden & Trenton Railway Company has been increased to $1.750,000.

### NEW YORK

PLATTSBURG, N. Y.—The right of way for the trolley road from Lake Champlain to Lake Placid is now being secured.

BUFFALO, N. Y.—The surveys for an extension of the Buffalo & Williamsville Electric Railway through Batavia to Rochester are being made.

REDWOOD, N. Y.—The Standard Construction Company has received the contract for the construction of a trolley line from Redwood to Alexandria Bay.

SALAMANCA, N. Y.—Mr. A. E. Darrow, of Little Valley, has been elected president of the newly incorporated Salamanca & Little Valley Railroad Company.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company has established a new belt line trolley service to furnish adequate transportation in Greenpoint and the eastern district.

SCHENECTADY, N. Y.—The Schenectady Railway Company has filed a certificate with the Secretary of State announcing that it proposes to build and operate certain branches and extensions.

WATERFORD, N. Y.—The superintendent of public works, Colonel John N. Partridge, has authorized the reconstruction of the bridge of the state over the canal in Waterford by the United Traction Company. This will permit of the construction of a bridge sufficiently strong to support the heavy trolley cars of the Hudson Valley Railway Company.

### OHIO

GERMANTOWN, OHIO—The Southern Ohio Traction Company has purchased the road which operates between Miamisburg and Germantown.

PEMBERVILLE, OHIO—The work of constructing the new electric railroad, which is known as the Lakeside & Napoleon, is progressing rapidly.

CINCINNATI, OHIO—It is said that contracts will be let within a short time for converting the Cincinnati, Georgetown & Portsmouth Railway into an electric road.

CANTON, OHIO—The Everett-Moore Syndicate, of Cleveland, has purchased the Canton-Akron electric line, which forms a connecting link in its system of electric traction lines.

### ONTARIO

PETERBORO, ONTARIO—Mr. E. M. Block, of Buffalo, has purchased the Peterboro & Ashburnham Electric Railway. The price paid is said to be about $150,000.

### PENNSYLVANIA

CHESTER, PA.—Work has been begun on the Media, Middletown & Ashton Railway.

SEAFORD, PA.—The power plant which has been under construction here is nearly completed.

WASHINGTON, PA.—The work of construction has been begun on the foundation of a new power station for the Charleroi & West Side Street Railway Company.

NEWCASTLE, PA.—It is said that the purchase of the rights of way by the Newcastle & Sharon Electric Railway have been practically completed, and that the work of construction will soon be begun.

### TEXAS

DALLAS, TEX.—The work of laying heavier steel rails on Main street for the Northern Texas Traction Company has been begun.

### VIRGINIA

RICHMOND, VA.—It is reported that Mr. George E. Fisher, who owns the Richmond Passenger and Power Company, has purchased the Richmond & Petersburg Railroad.

### WASHINGTON

ABERDEEN, WASH.—A franchise to build an electric street railway system was applied for at a meeting of the council by Mr. Samuel Benn.

### WEST VIRGINIA

WELLSBURG, W. VA.—Over 200 men are engaged in constructing the road-bed of the Northern Ohio Valley Traction Company's line between Wheeling and Wellsburg.

### WISCONSIN

SHAWANO, WIS.—The organization of a stock company to build an electric railway from Shawano to Green Bay is being agitated.

## OBITUARY NOTICES

MR. LEW W. WELSH, who was a well-known telegrapher in the West, died suddenly at Milwaukee, Wis., on November 4, of heart trouble, at the age of thirty-nine years. For several years Mr. Welsh was connected with the Associated Press. He was well known in commercial and railway telegraph circles.

MR. HENRY HART, one of the most picturesque and interesting figures in the history of American street railroads, died November 7 at his home in New York city. Mr. Hart was ninety years old, and his death was due to old age. His beginning was very humble, his first business after coming to New York from England, where he was born, being a boy of all work in a Chatham street clothing store. With the savings accumulated, he opened a pawnbroking establishment, and after several years of success branched out into larger fields and became actively connected with the enterprise for building a street railroad in the Bowery and Third avenue in New York city. By careful attention to all of the minutia and details of the business, Mr. Hart arose to be a street railway magnate and amassed a very large fortune. Many stories are told of his peculiarities and eccentricities. He was personally very popular with those who came in contact with him.

MR. JAMES W. GODFREY, general sales manager of the India Rubber and Gutta-Percha Insulating Company, of New York, died Saturday evening, November 9, from injuries received in a driving accident a few hours before. Mr. Godfrey, who was very widely known in electrical circles, was an enthusiastic horseman and owned several fast road horses. While driving one of them to a light wagon in the northern part of New York city just at dusk Saturday, he encountered a heavy team, and turning out to avoid it ran into a pile of excavated material carelessly left unmarked by a light. The vehicle overturned and its occupants were thrown out, Mr. Godfrey falling on his head and receiving injuries from which he died in a few hours without regaining consciousness. The gentleman accompanying him escaped without material injury. Mr. Godfrey had been associated with Dr. W. M. Habirshaw in the manufacture and sale of high-class insulated wires and cables for many years. His genial and hospitable nature had won for him the esteem of a very large circle of friends and acquaintances in all branches of the electrical profession. He is survived by a widow and two daughters, one of them married.

## ELECTRICAL SECURITIES

The financial press of New York is calling attention to the very strong conditions upon which American industry and finance now rest. It will be remembered that six months ago Wall street was in the agonies of one of the severest panics of its history. This panic was precipitated by the corner in Northern Pacific stock. Since that period the protracted steel strike, the almost failure of the corn crop and the assassination of President McKinley have come, and yet it is a notable fact that prices to-day are but slightly lower than was the case early in May prior to the panic. In almost any country but our own, where the industrial and financial structure is so strong, these successive disasters would have caused much greater confusion. The market is apparently regaining some of its buoyancy and closed the week with an improved showing in prices. There is evidence of increasing public interest and much purchase of securities for investment. Reports bearing upon the state of the country's trade continue gratifying and data is supplied substantiating this in the bank clearances throughout the country and by the returns of the steam railways. There is some discussion as to what Congress will do, which meets in about two weeks, and President Roosevelt's message is awaited with much interest. His simple declaration on taking office that he intended to follow the same policies adopted with signal success by his predecessor should be remembered. The clearing house banks of New York closed the week with surplus reserves amounting to $8,690,000.

ELECTRICAL SECURITIES FOR WEEK ENDING NOVEMBER 9.

| *New York:* | Closing. |
|---|---|
| Brooklyn R. T. | 67⅜ |
| Con. Gas | 219 |
| Gen. Elec. | 256½ |
| Man. El | 127½ |
| Met. St. Ry. | 162⅞ |
| Kings Co. Elec. | 190 |
| N. Y. & N. J. Tel. Co. | 167 |
| Telep. Tel. & Cbl. Co. | 6 |
| *Boston, November 9:* | Closing. |
| Am. Telep. & Tel. | 157¾ |
| Erie Tel. | 22 |
| New Eng. Tel. | 132½ |
| Mass. Elec. pf. | 94 |
| Westing. Mfg. pf. | 78 |
| Edison Elec. | 245 |
| *Philadelphia, November 9:* | Closing. |
| Elec. Co. of America | 6¾ |
| Philadelphia Elec. | 5½ |
| Union Traction | 28 |
| United G. I. Co. | 118 |
| Elec. Stor. Bat. c. | 60 |
| Elec. Stor. Bat. pf. | 75 |
| *Chicago, November 9:* | Closing. |
| Chicago Edison Light | 162 |
| Central Union Telephone | 82 |
| Chicago Telep. | 250 |
| National Carbon | 20½ |
| National Carbon pf. | 82½ |
| Un. Trac. | 17 |
| Un. Trac. pf. | 54 |
| Metropolitan El. | 90 |

## PERSONAL MENTION

COUNT VON MOLTKE, who was commissioned by the Prussian Parliament to study our methods of transportation, has sailed for Europe. Count von Moltke is the chairman of the committee on transportation in the Prussian Parliament.

MR. R. F. Ross has accepted the position of general manager of *Insurance Engineering*. This is an enterprising publication of the insurance field and its success will undoubtedly be rapidly advanced in the capable hands of Mr. Ross, who was for a number of years identified with electrical publications and who has a wide acquaintance in the publishing field.

MR. T. H. SYMINGTON, who was until recently superintendent of motive power of the Atlantic Coast Line Railroad, and later president of T. H. Symington & Company, Baltimore, has accepted a position as representative of the Gold Car Heating Company, of New York and Chicago. Mr. Symington, who is a graduate of Johns Hopkins University and who also took the degree of mechanical engineer from the Lehigh University, has had a number of years of practical experience in the shops and mechanical department of the Baltimore & Ohio Railroad.

MR. JOHN I. SABIN, president of the Central Union Telephone Company, of Chicago, Ill., has had the satisfaction of increasing the number of this company's subscribers over twenty per cent since he assumed the presidency a few months ago. The number has been increased from 75,000 to 90,000. A thorough canvass is being made and improved apparatus and more efficient service are being introduced as rapidly as supplies can be secured. A considerable increase in the number of subscribers has been secured for the Chicago Telepnone Company, of which company Mr. Sabin is also president.

BRIGADIER-GENERAL A. W. GREELEY, chief of the signal corps of the army, has just returned from the Phillipines, where he has been on an inspection tour. General Greeley reports that he found the conditions more favorable than he had expected. While there a thorough inspection of the military telegraph lines in the islands was made, and they were found to be in satisfactory operation. General Greeley returned to the United States by way of Europe. Arrangements with the cable and telegraph companies connecting Manila were completed by which a reduction of about one-third of the former rates was secured.

MR. WILLIAM H. CRUMB has lately resigned his position as general superintendent of the Pittsburgh & Allegheny Telephone Company, of Pittsburgh, and has opened an office in the Monadnock Block, Chicago, for the general practice of telephone engineering and contracting. On account of his prior connection with the Central Union Telephone Company, and his important position with the Pittsburgh company, Mr. Crumb is well known in Chicago, and on account of his wide experience in both constructing and operating telephony, is especially well fitted for the business he has recently undertaken. Mr. Crumb was graduated from Cornell University in 1894 with the degree of electrical engineer.

MR. E. B. BAKER, who has been general superintendent of the Southern New England Telephone Company ever since the company was organized, has tendered his resignation to take effect May 1 next. Mr. Baker probably outranks any other person in the country in continuous and active telephone service, having built the second telephone exchange established in the world, at Meriden, Ct., and opened it for service in January, 1878. Mr. Baker has been continuously connected with telephone interests ever since and has practically superintended the building equipment of all of the Southern New England Company's lines in Connecticut. While no reason has been stated as yet for his resignation, it is believed that Mr. Baker will hereafter become identified with interests to which his long experience in telephony will make his services very valuable.

## ELECTRIC LIGHTING

MANCHESTER, N. H.—A new electric plant will soon be erected in the yard of the Amoskeag mills.

TERRE HAUTE, IND.—Extensive improvements are being made by the Terre Haute Electric Company at its power-house.

NILES, OHIO—The electric light plant which has been operated by a private concern has been purchased by the city.

WEBSTER, S. D.—The contract for the erection of a city waterworks and electric light plant has been let to the Allen-Black Company, of St. Paul.

MIDDLETOWN, OHIO—Mr. Paul J. Sorg, of Middletown, has placed a contract with Morse, Fairbank & Company, of Cincinnati, for an electric light plant.

EPHRATA, PA.—Negotiations are being carried on by the Lancaster County Railway and Light Company for the purchase of electric light plants in Ephrata, Manheim and Mt. Joy.

BRAZIL, IND.—The city council has awarded the contract for lighting the city for ten years to the Brazil Brewing, Ice and Power Company. An electric lighting plant will be erected at once.

POUGHKEEPSIE, N. Y.—The Poughkeepsie Gas Light Plant has been transferred to the new Poughkeepsie Heat, Light and Power Company. It is said that the consideration was about $140,000.

BATAVIA, N. Y.—Arrangements have been completed by the Consolidated Gas and Electric Company for lighting the buildings at the State School for the Blind with incandescent electric lamps.

WATERBURY, CT.—The contract for wiring the state capitol, which is to be lighted by electricity, has been awarded to the New England Engineering Company. The contract provides for wiring for 3,931 lamps.

MANHEIM, PA.—The Lancaster Railway and Light Company is negotiating for the purchase of the electric light plant. This includes the Mount Joy franchise, the light for Mount Joy being furnished from Manheim.

CINCINNATI, OHIO—The Cincinnati Gas and Electric Company is about to make extensive improvements in two of its power plants. The engine and boiler rooms of these power plants will be practically reconstructed.

HOUSTON, TEX.—The Citizens' Electric Light and Power Company is about to make extensive improvements in the near future. It is said that about $50,000 will be expended in equipping the plant, which is to be remodeled throughout.

HARRISBURG, PA.—The directors of the Steelton Heat, Power and Light Company have decided to run a line from its plant to the eastern end of Harrisburg to supply the business places and private residences of that city with electric light.

CAPE MAY, N. J.—News comes that the Philadelphia & Reading Railway Company has purchased the plant of the Cape May Electric Company, which lights Cape May. It is said that the Reading company proposes to build a trolley road through Washington street to Schellengers Landing.

DULUTH, MINN.—The council of Duluth has been petitioned for a franchise to erect poles and string wires in the streets for the transmission of electric power by the Black River Falls Company, of Douglas County. The company is organized to convert the power at the Black River falls into electric energy and transmit it to Superior and Duluth.

## INDUSTRIAL ITEMS

THE STERLING-MEAKER COMPANY, of New York, has secured contracts for a large number of brakes for Portugal tramways.

THE STERLING ELECTRIC MOTOR COMPANY, Dayton, Ohio, has issued a bulletin of its shielded type of small direct-connected motors.

THE BULLOCK ELECTRIC COMPANY, of Cincinnati, Ohio, is furnishing the equipment for the American Electric Railway which is now under construction in Porto Rico.

THE ST. LOUIS ELECTRICAL SUPPLY COMPANY, St. Louis, Mo., is placing on the market an electric wire clamp in varying sizes manufactured under the Fletcher patents.

THE SHULTZ BELTING COMPANY, St. Louis, Mo., is remodeling its factory and doubling its capacity, and for the accomplishment of this its entire establishment will be closed down for a month.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is sending out a complete descriptive circular, giving cuts and prices of the Newgard water-proof receptacle in the various styles in which it is made.

THE UNION SWITCH AND SIGNAL COMPANY, of New York, is reported to have secured an order for a number of automatic electric semaphores to be used on the government railways in South Africa.

THE GEORGE V. CRESSON COMPANY, of Philadelphia, is reported to have secured contracts for power-transmission machinery for an electric light plant at Manila, a sugar crushing plant for Cuba, and a tube mill for Mexico.

THE COLUMBIA TELEPHONE MANUFACTURING COMPANY, of Chicago, is preparing to enlarge its factory in order to meet the growing demand for its output. The company has been obliged to increase its facilities by putting on a night force.

THE MANHATTAN ELECTRICAL SUPPLY COMPANY, of New York, received orders recently for general electrical supplies from South America, Great Britain, British India and Australia. The export business of this company is increasing very rapidly.

MR. J. M. GRAVES, who recently graduated from the scientific department of the Kentucky University, has been appointed to the position of electrical and mechanical engineer in the plant of the Chicago Insulated Wire Company, located at Sycamore, Ill.

THE REYNOLDS ELECTRIC COMPANY, of Chicago, is shipping its flashers to cities in all parts of the country. Mr. O. D. Ziegler, of the company, says that wherever signs are equipped with the Reynolds flasher it means a saving in cost of operation which always gives satisfaction.

"PROFITABLE ADVERTISING," published by Miss Kate E. Griswold, has taken larger quarters at 140 Boylston street, Boston, Mass. This journal is a unique publication for students of good advertising, and is a striking illustration of excellent composition, presswork and engraving.

THE CENTRAL ELECTRIC COMPANY, of Chicago, Ill., is advertising the Hubbell pendent pull socket, which is convenient for chandeliers, wall sockets, etc. It is provided with a chain ten inches long in place of a key. This socket is said to have been approved by the National Bureau of Fire Underwriters.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, has under construction several batteries for United States Government service, two of them being for Fort Washington, Md., and one for Fort Hunt at Sheridan Point, Va. These are to be operated in connection with the lighting and power stations now being erected at these points.

THE AMERICAN ELECTRIC TELEPHONE COMPANY, of Chicago, reports a great demand for its telephones. As fast as the apparatus is finished it is packed and turned over to the railways which are taking it to every part of the United States. The company has been obliged to organize a night shift of workmen in order to fill its orders.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, of Chicago, is manufacturing a 3,000-line Major multiple switchboard for the People's Telephone Company, of Jackson, Mich. Included in this contract is a toll board with an equipment of thirty lines, a chief operator's desk, 1,400 wall telephone sets, and 100 desk sets complete.

THE CENTRAL ELECTRIC COMPANY, of Chicago, is distributing to the trade a bulletin on Pittsburgh transformers, describing in detail the transformer wiring for three-wire secondary distribution. This bulletin should be of interest to all central station managers. The company will be pleased to send copies to all who have not received them.

MR. A. L. DYKE, of St. Louis, Mo., engaged in the automobile supply and parts business, states that his new fifty-page catalogue is now ready for distribution. This catalogue contains sectional views and illustrations of three types of gasoline machines and two styles of steam machines together with a full description of Dyke's carburetors, coils, plugs, batteries, etc.

THE EXPOSITION to be held at Charleston, S. C., will open December 1 with a preliminary religious service as this date falls on Sunday. The Sunday services will consist of an elaborate programme of sacred music under the direction of Madame Barbot, of Charleston, who has organized a special chorus. The official opening of the exposition will take place on December 2.

THE H. C. ROBERTS ELECTRIC SUPPLY COMPANY, of Philadelphia, Pa., has taken the agency for the Mica Insulator Company for its special lines of goods consisting of micanite plates, segments, empire cloth, oil papers, linings, etc. Sample books and advertising matter on the subject are being sent out by the company. The sales which have been made up to the present time have been very gratifying.

THE AMERICAN BATTERY COMPANY, of Chicago, has issued an elaborate price list of its American storage cells which received the highest award at the World's Columbian Exposition in Chicago. It contains also description of the construction of the different parts of the cells. The same company has issued a price list of the American portable storage cells. It contains an elaborate description of these cells.

"THE FOUR-TRACK NEWS" is the latest addition to the literature of the New York Central & Hudson River Railroad. It is a neat, illustrated pamphlet published under the direction of the general passenger agent, Mr. George H. Daniels. It is to be published monthly and will contain timely notes of travel, interesting information relating to transportation and its development and brief notes on books of travel.

THE NATIONAL CONDUIT AND CABLE COMPANY, of New York, is to furnish the cable required for an extension of the Glasgow Corporation Tramways. The value of the contract is said to be about $250,000. The cable will be manufactured at the plant of the company at Hastings-on-the-Hudson. The company secured the contract for the supplying and laying of the conduits for the electric traction system already in operation in that city.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, Mo., general sales agent for the Adams-Bagnall lamps, states that it is meeting with flattering success with its weather-proof, solid copper case, constant-current, series-enclosed type of this lamp. It states also that the demand for this type of lamp has been increasing, and that it is installing them in a number of large cities. Descriptive matter, prices, etc., will be mailed on application.

ROSSITER, MACGOVERN & COMPANY, 141 Broadway, New York, have acquired a large lot of lighting machinery which they are offering at particularly low prices so as to close out before the season is over. This includes alternating, arc and incandescent dynamos. The offer will certainly be an attractive one to electric lighting companies of the country. Requests for further information should be sent to the company's office, and will receive prompt attention.

THE KEYSTONE ELECTRICAL INSTRUMENT COMPANY, of Philadelphia, Pa., is now putting on the market its Type K switchboard, voltmeters and ammeters. These are identical in construction and appearance with its Type K illuminated dial instruments, the only difference being that the scales are not illuminated. It is said that these instruments are suitable for use in installations where the general illumination is sufficient to enable readings to be made, without the assistance of an illuminated dial.

THE AMERICAN ELECTRICAL HEATER COMPANY, Detroit, Mich., manufacturer of electrical heating devices, announces that great progress has been made toward the higher appreciation of the value of electrical heating apparatus as indicated by the remarkable growth in its business during the last few months. The company reports a greater demand than ever before for various types of electrical heating apparatus, such as laundry irons, heating stoves, soldering irons and special adaptations. This company issues a comprehensive catalogue which it will send on application.

THE GUARANTEE ELECTRIC COMPANY, of Chicago, affirms that the fall trade is meeting its most sanguine expectations. Mr. Gregory, president of the company, says that the business of his company is confined to no section of the country. He has lately shipped a dozen machines to Mexico, and is equipping a number of southern lumber camps with dynamos and lamps. Recent orders received from Canada give promise also of expansion of his business in the domains of King Edward. "Business could not be in a healthier condition than it is to-day," said Mr. Gregory, "our trouble is in filling orders, not in getting them."

THE HUBBELL-GRIER ELECTRIC COMPANY, of Bridgeport, Ct., was organized October 18, under the laws of the state of New York. The officers are Harvey Hubbell, president; Edward R. Grier, treasurer and manager; Thomas G. Grier, western manager, and Francis E. Laimbeer, secretary. The above named are the directors of the company. The capital stock is $25,000. The company is formed for the purpose of manufacturing the Hubbell electrical pull specialties. E. R. Grier has been associated with the Bryant Electric Company for the past ten years as its western manager. The company's plant will be located at Bridgeport, Ct., with a New York office at 93 Nassau street.

THE MONARCH MANUFACTURING COMPANY, of Waterbury, Ct., and the Springfield Engine-Stop Company, of Springfield, Mass., have recently been absorbed by the Consolidated Engine-Stop Company, and which is formed for the purpose of consolidating all the principal engine-stop interests and patents. Offices of the new company will be in Waterbury, Ct., at the old offices of the Monarch Manufacturing Company. The management and policy of the new company will remain practically the same as existed with the Monarch Manufacturing Company prior to the consolidation, with Mr. L. W. Sweet, N. A. S. E., former general manager of the Monarch Manufacturing Company, as secretary of the new company.

# List of Electrical Patents Issued Last Week

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED NOVEMBER 5, 1901.

685,742 Wireless telegraphy; A. F. Collins, Philadelphia, Pa.

685,745 Automatic fire-alarm; B. A. Crisman, St. Elmo, Tenn.

685,754 Semaphore operating mechanism. C. C. Gardiner, Topeka, Kan.

685,755 Controller for electric railway motors; F. W. Garrett, Johnstown, Pa.—Consists of a regulating switch, a reverse switch having an open-circuit position between its ahead and back positions, external resistance for connection in the motor-circuit, and means for automatically inserting said resistance in the said circuit by the movement of the reverse switch across its open-circuit position.

685,766 Magnetic fuse cutout; Noble Jones, Sparrow Point, Md.—A fuse block provided with suitable line-clamps at each end, and a fusible conductor, an electromagnet embedded in the fuse-box beneath the fuse and about midway between the ends thereof, and which magnet is in series with the fuse and the fuse exposed directly to the magnet.

685,781 Electric railway motor controller. F. A. Merrick, Johnstown, Pa.

685,795 Means for operating and controlling electric motors; C. J. Reed, Philadelphia, Pa.—An electric motor having its armature and field circuits supplied from separate sources of electrical energy and means controlled by variations in the armature-current for effecting correlative variations in the field current.

685,796 Method of operating and controlling electric motors; C. J. Reed, Philadelphia, Pa.—The method of operating electric motors, which consists in supplying the armature and field circuits with substantially independent currents, and causing the field currents to automatically vary as the armature current varies.

685,797 Accumulator electrode; A. Ricks, Berlin, Germany—Consists of a non-conducting base provided with ribs or grooves, an active mass and an adhesive substance of inactive material firmly connecting said base and mass.

685,817 Magnetic ore separator; W. P. Cleveland, Joplin, Mo.

685,846 Switchboard for telephone or like exchanges; H. F. Jones, Wilson, N. C.

685,847 Switchboard for telephone or like exchanges; H. F. Jones, Wilson, N. C.

685,852 Motor starting and controlling device; C. W. Kragh, Madison, Wis.

685,860 Indicating device for sparking igniters of gas engines; A. McTighe, Allegheny, Pa.

685,887 Pole changer; W. F. Warnock, Muncie, Ind.

685,953 Method of intensifying and utilizing effects transmitted through

(Continued on page 38.)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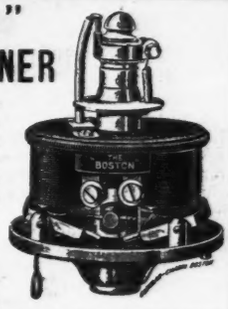

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## PATENTS.

(*Continued from page 37.*)

natural media; Nikola Tesla, New York, N. Y.

685,954 Method of utilizing effects transmitted through natural media; Nikola Tesla, New York—The method of utilizing effects or disturbances transmitted through the natural media, which consists in charging a storage device with energy from an independent source, controlling the charging of said device by the action of the effects or disturbances, and coincidently using the stored energy for operating a receiving device.

685,955 Apparatus for utilizing effects transmitted from a distance to a receiving device through natural media; N. Tesla.

685,956 Apparatus for utilizing effects transmitted through natural media; N. Tesla.

685,957 Apparatus for the utilization of radiant energy; N. Tesla.—Comprises a condenser, one armature of which is subjected to the action of rays or radiations, independent means for charging the other armature, a circuit and apparatus therein adapted to be operated or controlled by the discharge of the condenser.

685,958 Method of utilizing radiant energy; N. Tesla.

685,960 Electrical ignition device for explosion engines; Z. Wirt, London, England.

685,965 Electric furnace; C. P. Bary, Paris, France.

685,966 Winding for dynamo electric machines; J. B. Blood, Newburyport, Mass.—A winding composed of detachable counterpart coils, the layers of which are in vertical relation and each layer wound horizontally.

685,978 Electric igniter for gas engines; J. B. Fenner, Buffalo, N. Y.

686,007 Relay; H. Shoemaker, Philadelphia, Pa.

686,020 System of electrical distribution; F. Bedell, Ithaca, N. Y.

686,023 Armature for electric metres; C. W. J. Busch, Munich, Germany.

686,073 Electrically controlled combination lock; W. H. Hollar, Philadelphia, Pa.—A series of tumblers, an electric motor, rotatable, independent of said tumblers, and means to actuate said tumblers by said motor at the will of the operator.

686,074 Telephone toll signal and collector; A. Holzmann, Brooklyn, N. Y.

686,128 Nipple for electric conduits; A. C. Proudfit, New York, N. Y.

686,135 Electrical sounder; U. G. Rogers, New York, N. Y.

(*Concluded on page 40.*)


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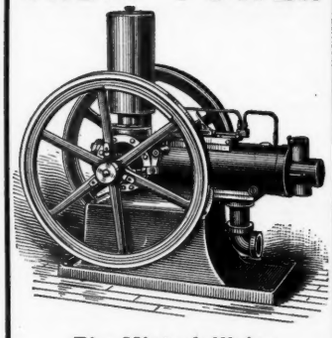
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